THE

AMERICAN NATURALIST

VOL. XXIV. SEPTEMBER, 1890. 285.

A MEANS OF PRESERVING THE PURITY AND ESTABLISHING A CAREER FOR THE AMERICAN BISON OF THE FUTURE.

BY ROBERT C. AULD.

I.

THE American bison is, as it nearly always has been, and ever will be, possibly the most interesting and attractive of all mammals. The lamentable, outrageous war of extermination to which he has been subjected is certainly one atrocious specimen of man's most wanton foolishness, for which he ought to blush. Doubtless that extermination is at last regarded with the keenest feelings of remorse; which, though now of so little avail, yet fill those who have latterly championed his cause with fond desires for the recuperation of what is apparently almost a vanishing race. The American bison is, in his royalty, gone,—"passed over" into history. The hardly even smoldering embers that remain,—can they be nursed, fanned into a greater brilliance that might give one the hope of their being revivified into a more life-like, enduring flame?

From numbers that would have put into total insignificance the combined forces of all the various bovine species (and races), for instance, there now remain—how many? The very best that Mr. W. T. Hornaday can figure, they can only be marshalled at a total of one thousand and ninety-one in the entire world. This number

is less, positively, than that claimed by even some of our most improved domestic bovine races. The enumeration takes into account, of course, all individual and scattered specimens in different foreign Zoological Gardens, which are uninfluential on the main body on which depends the fate—so doubtful now—of the species. This main body, this specific entity, this restricted, smothered force, on which the future fate of recuperation depends, —that is, taking into account those only which we know of that can, or could, be utilized for ordinary breeding purposes,—the most that we could liberally estimate such a force at would not be far from about two hundred and fifty. Two-and-a-half hundred: can we do anything for you to redeem the obloquy of the past? Is it possible to preserve that trivial remnant? It would seem presumption to make any assertion to that effect in the face of the transforming rapidity of the extermination from the many countless hordes to the few insignificant herds. Those most interested in the fate of this remnant have, I fear, dire misgivings as to the result. For an animal that was so long so absolutely monarch of his prairie domain,—till the relentless and vicious paleface and the no less destructively inclined redman, finding him generally such an easy prey to their various refined and rude means of murder, made so much more resistless by an animal that had not yet learned the fear of, or to beware of, man's ruse or craft, reduced him to his present state of insignificance,—for such an animal to be expected to re-create itself into some more enduring adjunct of his old enemy's wants, would seem unnatural. The products that were the incitement to this awful slaughter had to be piled almost horizon-high, and then it was not enough to subdue the insatiable, inconsiderate greed of the so-called honorable hunter who followed such a legitimate calling. The lucre-returning "product" was only a trifling portion of the whole. The waste was outrageous, stupendous in its extravagance. Hence the Assyrian-like destruction. For an animal that had reared itself through centuries' implantation of nature's own freedom, instinct, unrestraint, and environment, to be dragged through such abject degradation, and be asked to survive, would seem an insult to this lagger behind,

"superfluous on the stage," left all alone. It would be a modern incongruity, not an instance.

From the generally apparent characteristics and qualities of the species, the sympathizer would entertain—regretfully entertain—a decided negative. Yet often when there is least expectation hope revives.

The buffalo has had, even during all that destruction-dealing process, before his death throes, observers who have, incidentally it would appear, recorded a certain number of facts about their, too noble prey, which are now positively encouraging to us. For instance, for an animal regarded to be an embodiment of mammalian ferocity, it would appear incredible that such an animal should have any inherent traits of gentility or docility. But such is, indeed, the fact. In his experiences with his bitter foe, as forestated, ere the latter days of his regal existence,—before the knowledge of that foe's contiguity engendered an idea of a danger to flee from, which became an instinct and thence an hereditary transmission,—he was indifferent, even disdainful, of the feeling of his comrades at his side; proud, confident in the midst of the great horde that, unaffected still, stood its ground. During that period there are numerous records of calves which, in the hunt or onslaught, having been left behind or become separated from the main body, and particularly from their own dams, were very easily, by simple means, attached to the destroyer of his maternal and paternal mainstay, and "blindly" following at the heels of the man-horse murderer, with all the same signs of affection they would show to their own dams. That trait was, surely, a strong one, indicating a strong nature or disposition, shaped and controlled in the most pronounced manner by environment; just as sure in captivity to be influenced by the subduing, gentling power of man when exerted on an immediate object and with certain kind solicitude, which was fully reciprocated in that object, as in nature to be influenced by the overcoming fierce, instincts of free environment, when that was provocative of suspicion and antagonism to their worst, latterly forced-on-them, natural enemy. Such calf-disposition was a strange concomitant; and for us it is a starting-point in that which makes us hope.

Indeed, when we come to investigate further, we find that even from the earliest times the great and ferocious American buffalo had been subdued, domesticated in fact, and even crossed with the farm bovine. This buffalo blood doubtless runs in the veins of a proportion of the common bovines of to-day as another "alloy," showing how easily his type could be absorbed.

When we press this point to its utmost we find that the buffalo is fully amenable to the domesticating process; and further that he demeans and conducts himself similarly and as truly as his more sedate and cooler-blooded bovine cousins. What is suitable to the one is suitable to the other.[1]

Leaving that most important point of domesticability, it might yet be objected that we would have no use for the species. Well, we assert that the buffalo, considering the conditions under which he has been reared—as seen and delineated by Catlin—on his native heath,[2] is far and away ahead of the common bovine as a beef animal, naturally fed. Compare this animal in his natural bisontine condition with the fleshless results among the bovines under the same conditions, in spring or at any period, on the former's prairie or the latter's ranche or range, and our assertion is at once borne out. This, remember, on "grass alone." Here, then, we have in the buffalo an animal exactly evolved out of his environment to fill the true American beef-producing animal's place, without any recourse to the tricks of shelter or winter fodder, as conceived by man for the benefit of a more cosmopolitan constructed bovine. We have gone far enough on these two lines to bring us to the great conclusions as to the buffalo necessary for our plea, viz:

1. His amenability to domesticity being perfect.
2. His economic value being incomparable.

[1] See article by the writer, "The American Buffalo: Its Past and Future," in the February number of *Baily's Magazine of Sports and Pastimes*. Vinton & Co., London, Eng.

[2] See Report of National Museum, 1886-'87, on "The Extermination of the American Bison," by William T. Hornaday.

II.

Having come to this most important conclusion, that in the American buffalo we have an animal superbly endowed by nature, not by artifice, to fill the bovine requirements of this country, made ready to hand, but his thorough adaptability unperceived or selfishly overlooked, we have now to consider the possibility of realizing our dream: *i.e.*, establishing his destiny as an animal of such utility as is proved he possesses. We can resign the old romance, but we can not risk the reality in so far as that can be preserved and enhanced. The buffalo, as he has been known, will be known no more. Established in the place his destinators would prepare for him, he will be an entirely different-natured—and even nurtured—being from that from which he was forcibly exiled; and, fulfilling the mission proposed for him, he will become greatly modified from the noble monarch of old. This is inevitable and consequent. We see the effect of the same treatment on the bovine species, which was also a wild species subdued at a comparatively recent period. Even the wild white cattle of Britain, kept in the parks from the earliest times, the most direct descendants of *Bos urus* (*primigenius*), are greatly modified from their ancestors by the restricted area and nature of their confinement. So it is with the truest representative of the buffalo in Europe, the Aurochs (*Bison priscus*) of the Lithuanian forests. But for all these instances we believe that in the buffalo of the future we shall, as the result of our judicious interference, our subduction and care, the resultant of his removal from his natural environment, see arise a new race thoroughly capable of enacting an undreamt-of career, and that with happier results than might formerly have been possible; for that former career of his was apparently doomed and destined to be sooner or later played out on the plains that witnessed his early glory.

We have now to consider the species as it is, for our purpose; its numbers and how composed. The following list gives the location of the different herds and numbers they contain, fit for breeding purposes, in the United States. The location simply is

given; further full particulars may be found in the elaborate report referred to in the note:

Location of Herd.	Number.
Garden City, Kan.,	115
Flathead Indian Reservation, Montana,	35
Clarendon, Texas,	13
Bismark Grove, Kan.,	10
Fort Bennet, Dak.,	9
Rapid City, Dak.,	4
Wood Lawn, Neb.,	5
Hamline, Minn.,	2
Glen Island, N. Y.,	4
Other places,	12
Wild West Show,	18
Public Park, Philadelphia,	10
" " Chicago,	7
" " Cincinnati,	4
" " New York,	4
" " Washington,	2
	254

For comparison we give the following figures to show the distribution of the entire number known:

Total captive, fit for breeding purposes in America,		254
Wild, under Government protection in Yellowstone Park,		200
Running wild unprotected:		
In United States,	85	
In Athabasca,	550	635
In foreign countries,		7
Total,		1096[3]

It will thus be seen that the number of those fit for breeding is only a fourth of the entire number. This number might

[3] See pp. 458, 525, of Mr. Hornaday's Report already noted.

possibly be added to in the future by new captures from the wild herds. Now, what do we propose to do with these remnants to preserve them from the surest forms of destruction that seemingly await them, if not carefully avoided: (*a*) in breeding, and (*b*) out-crossing? For there is just now as much danger from the latter as from the former.

We are not in the position of the "early improvers" of the bovine race; that is, of those who took it in hand within the last hundred years to rescue from a conglomerate promiscuity the various types of bovine excellence. By them in-breeding was necessary, essential, primarily, to establish the type. Their period of out-crossing had been going on during the centuries previous to the commencement of the improving period. But we have no type to establish; in fact, hardly any characteristics to improve; we have only to use those means of amelioration which captivity, that is, domesticity, brings. Therefore we, and it is fortunate for us, do not need to resort to the usual initial essential of in-breeding. But that is, nevertheless, the chief thing; in fact, with the limited alliances at our disposal, the main thing to avoid. And it is as to a means to avoid that, that the vital purpose of this paper is designed to deal.

The danger of out-crossing is the establishment of a mixed or bastard race of bisontine-bovines. The danger is real, but the means of avoiding the first danger—in-breeding—covers this.

With the alliances existing, what can be done to increase them, and not to circumscribe their area, not to bring their points of convergence too close? We have to widen these points as much as possible. Within the limits of the existing relationships—which are in reality just now sufficiently distant, that is, in so far as tracing to their common ancestors is concerned—we have to out-cross as much as possible. This would appear to be an easy matter to do, by the simple interchange of blood from one herd to another. But that, under existing conditions of ownership, and want of cohesion of breeders as a whole, would likely soon prove abortive. We have to look for some means of effecting cohesion and a unity of purpose and interest among owners and breeders.

Let us avail ourselves of the experience, now so well methodized, of our forebears, the pioneers of improvement among the gentler bovine races. Their rescue from common obliteration was the Herd Book, and, in Great Britain at least, every distinct breed has now its register. The latest established ones have, practically, been the means of rescuing from obliteration certain valuable races. We learn an important lesson from this.

But we imagine we hear a whisper: But we have so few to register. Patience! In collecting material for forming the foundation of such an undertaking, the number of the individuals composing such foundation, even in the largest bovine breeds, numerically fell short, we imagine, of the number of individuals we buffalo men possess. Besides, our individuals are absolutely pure, and all up to the highest standard. It was not so with the bovine races. We have therefore the advantage of our cousins. Our subject is, if such a register were initiated to-day, at a point that it took at least a quarter of a century for the bovine improvers to accomplish. Of course it must be admitted that the bovines did not, could not, start with the certainty of absolute purity, because of the mixing between races previous to the initiating of these registers. In that our bovines had an advantage over us, as it relieved them considerably of the greatest and immediate danger of in-breeding, which they were able thence to resort to, but which we have to avoid. Is such a register possible for the the buffalo? I think so. Let us see.

We start, we believe, with a larger "foundation stock," and absolute purity—no sub-standards—as compared with the bovines: the two desirable essentials. We should therefore obtain a complete record of all the male and female buffaloes fit for breeding. We should have their relationship to each other noted, traced, and arranged in systematic manner.

Whom would we look to to undertake this? We have the National Zoological Park, recently established at Washington from the very interest manifested in the "passing of the buffalo," for the purpose of providing a receptacle for the remains of this noble representative of American fauna, and resuscitating it from total or immediate obliteration. As therefore such was the

origin of this National Park, we would put the matter under the superintendence of its accomplished Director, Mr. W. T. Hornaday, to whom our mutual friend, the buffalo (what remains of him) owes so much, to organize such a register for the regeneration of the bison, with such help as the Government could supply that would be necessary.

Such a register should have entered therein, in systematic manner, and with such full details as could be obtained, the history of each remaining herd and each male and female individually composing it. An inspector of the herds might be advantageously appointed to collect such matter on the spot. The initial entries at least should be free of charge; and such points as the following might be recorded:

1. Location of herd.
2. As near as possible, age, place of birth, or capture, of the original members of the herd.
3. Affidavit of purity.
4. For each younger member of the herd, sire and dam grandsire and granddam, if necessary.
5. Description, according to a schedule of details, with photographs if possible.
6. Nomenclature to be governed by the proverb that "brevity is the soul of wit," that is, each individual entry to be named; the name to be short and of one word. Indian names would be most appropriate, or such short names as have a direct connection with the subject.
7. Pedigree to rank through the side of the dam, which establishes the best means of afterwards tracing each succeeding entry, especially of sires.
8. As an appendix, a bibliography of the subject would be useful.

Such a register would make a handsome and highly interesting volume. Distributed among the breeders, they, sending in constant, periodical reports, would become generally and specially bound together in one great united experiment. From this intercourse and correspondence of the whole, judicious interchanges could be continuously made from time to time, and the process

and results of breeding constantly watched and guarded. Breeders, being bound by a common interest, would have the best means at their disposal of avoiding the fatal extermination of their herds, from an insufficient knowledge—without this source of intelligence —by too dangerous in-breeding. The register would supply them with the means of avoidance, the power of tracing to divergence the relationships of the sires and dams of stock for which they might desire to interchange. Thus divergent lines of relationships would be established, instead of their breeding to a convergent point, so that a broadening foundation would be obtained. Then the American buffalo would take rank as the true, because indigenous, beef ruminant, and have its place alongside the proudest breed of bovines in existence.

Thus the two fatal possibilities of (1) crossing-out, and (2) breeding-in, which must ever menace the uncertain existence of the buffalo, without such a method of prevention, would be entirely avoided. No better method than the one herein advocated can we conceive for the purpose designed than the register. The number of separate herds that such a register would develop would be vitality itself to "the breed." I think I hear this entire proposal scouted at as bold and chimerical. But this there can be little doubt is about the only chance left for rehabilitating the species as a whole. Breeding would then become a fine art; and it would put the undertaking on a lasting financial and commercial basis.

ORIGIN OF THE PLANE-TREES.

BY LESTER F. WARD.

THE fourth number of Volume XI. of Engler's *Botanische Jahrbücher* contains an elaborate article by Johann Jankó, entitled "Abstammung der Platanen." The writer treats the subject in the characteristic German fashion, approaching it in an exhaustive manner from every possible point of view; and his contribution throws much light upon this interesting type of plant life. He had thoroughly prepared himself by careful observations continued during a number of years, and by collections, made at different and critical seasons of the year, from all the species of Platanus growing wild or in cultivation in Europe. He had also carefully studied the fossil forms, apparently only from the published figures, and evinces a wide acquaintance with these as well. He makes a searching revision of the species, both living and fossil, reducing the former to three, with numerous varieties, and the latter to eight.

The object of the paper, as indicated by its title, is to derive the living species from the fossil ones, and to show the line of descent of the former. The title is, nevertheless, misleading, since it would imply that the author was seeking the origin of the genus itself. So far is he from this that he rules out of the genus all the archaic forms occurring in the earlier formations, including *P. nobilis* of Newberry, and gives no intimation as to whether he regards them as ancestors of Platanus.

The following is his disposition of the fossil species:

With *P. aceroides* (Göpp.) Heer, he unites: *P. aceroides cuneifolia* Gaudin, *P. cuneifolia* Göpp., *P. ettingshauseni* Mass., *P. gracilis* Ett., *P. grandifolia* Ung., *P. œynhauseniana* Göpp., *P. pannonica* Ett., *P. rugosa* Göpp., *P. sterculiæfolia* Ett., *Acer ficifolium* (Viv.) Brongn., *A. heerii* Mass., *A. heerii deperditum* Mass., *A. heerii ficifolium* Mass., *A. heerii productum* Mass., *Acer heerii tricuspidatum* Mass., *A. heerii trilobatum* Mass., *A.*

productum Al. Braun., *A. pseudocreticum* Ett., *A. tricuspidatum* Al. Braun, *A. tricuspidatum subintegerrimum* Al. Braun., *A. trilobatum* (Sternb.) Al. Braun., *A. trilobatum genuinum* Engelh., *A. trilobatum patens* Al. Braun., *A. trilobatum productum* Al. Braun., *A. trilobatum tricuspidatum* Al. Braun., *Acerites deperditum* Mass., *A. ficifolius* Viv., *A. incerta* Mass., *Cissus platanifolia* Ett. *Quercus platanoides* Göpp., *Q. rotunda* Göpp.

He regards *Platanus academiæ* Gaud., *P. dissecta* Lx., and *P. appendiculata* Lx. as varieties of *P. aceroides* Göpp., the last two as identical.

To *P. gulielmæ* Göpp. he refers *P. aceroides* var. Heer, from Greenland.

He recognizes *P. marginata* (Lx.) Heer, the *Viburnum marginatum* of Lesquereux's earlier works, as a true Platanus.

He considers *P. heerii* Lx. a variety of *P. primæva* Lx.

He excludes from the genus Platanus the following: *P. affinis* Lx., *P. digitata* Ung., *P. diminutiva* Lx., *P. dubia* Lx., *P. hercules* Ung., *P. jatrophæfolia* Ung., *P. latiloba* Newb., *P. nobilis* Newb., *P. obtusiloba* Lx., *P. recurvata* Lx., *P. sirii* Ung.

A number of these have been, of course, long ago abandoned; but of the American forms, *P. diminutiva*, *P. nobilis*, *P. obtusiloba*, and *P. recurvata* had not been hitherto challenged.

He ignores the following species: *P. antiqua* Watelet, *P. aspera* Newberry, *P. basilobata* Ward, *P. borealis* Caspary, *P. dubia* Watelet, *P. heterophylla* Newberry, *P. klebsii* Caspary, *P. papilloni* Watelet, *P. subintegra* Göpp.

Watelet's species were so imperfectly figured and characterized that little could be said of them, and he was perhaps justified in passing them by unnoticed. Still less was he called upon to take account of those of Caspary and Newberry, and the last one on the above list, none of which have, to my knowledge, ever been figured. He was entirely unacquainted with the works of the present writer in which *P. basilobata* has been made known, viz., the "Synopsis of the Flora of the Laramie Group," "Types of the Laramie Flora," and "Paleontological History of the Genus Platanus." The last-named paper was sent to him as soon as his address could be found, and he has acknowledged it, and sent in

return a reprint of his paper, together with other works of his. In his letter of acknowledgment he expresses a deep interest in the subject of basilar lobes, but does not say whether he accepts my interpretation of their significance. *P. basilobata*, as I have pointed out, is so closely related in other respects to *P. nobilis*, that but for this feature I should have included it in that species; and Sir William Dawson, who had already figured it from the Canadian Laramie as *P. nobilis*, has, in his Geological History of Plants, proposed to call it *P. nobilis* var. *basilobata*. Prof. Jankó would therefore naturally have affixed to this species, as to *P. nobilis*, his sweeping verdict, "non est Platanus."

But the question, as it seems to me, is not so much whether these aberrant forms really belong to the present genus Platanus, as strictly limited by the characters presented by the few surviving species of that ancient type, as whether they represent the ancestors of these modern forms. The genus Platanus, like its close relative Liquidambar, like the monotypic Liriodendron, and like those holding-over forms of coniferous trees, the Sequoia and the Ginkgo, presents all the indications of being the last of a long lineage, and paleobotany, in this as in the other cases named, shows that it was once far more abundant than at present. So prominent a group must have had an ancestry, and the archaic forms found in the American Cretaceous deposits bear evidence of constituting that ancestry.

One of the distinctive links in this chain of evidence proves to be the presence of basal lobes. Nearly effaced in the latest living type, *P. orientalis*, this feature, nevertheless, sometimes occurs there, and was actually found by the searching observation of Professor Jankó, who, without the slightest suspicion of its significance, but true to his instincts of describing everything he found, described it in the following language: "Den Blattgrund betreffend, fand ich bei *P. orientalis* einen sehr interessanten Fall, dessen ganze Entwickelung ich beobachten konnte und welcher als Uebergangsform von der lappigen in die schildförmige betrachtet werden kann. Bei jenen Blättern nämlich, wo der Ausgangspunkt der drei oder fünf Hauptnerven nicht an der Grenze von Stiel und Spreite ist, vergrössert sich nicht selten der letzte Zahn,

mit welchem der Blattrand den Stiel berührt, und streckt sich mehr vor als die übrigen Zähne des Blattgrundes. An den inneren Rändern dieses Zahnes entsteht mit der weiteren Entwickelung ein zweiter Zahn, und beide erscheinen schon als kleine selbständige Lappen; wenn nun deren Grösse so lange wächst, bis diese zwei kleinen Seitenläppchen an einem Punkte sich berühren, so beginnt das Wachstum von diesem Punkte aus nach unten, und dieser Teil der Lamina ist nicht mehr an den Stiel gewachsen, sondern sondert sich von ihm ab. Dieses Läppchen ist manchmal ziemlich gross und kann im Allgemeinen als Resultat einer progressiven Entwickelung betrachtet werden."

I have never found it in that species as introduced into our American parks, where care is taken to trim out the sprouts and low branches on which it would occur, if at all. Fig. 1 represents a typical leaf of that species. But in the American form *P. occidentalis* in its wild state, especially on those abundantly nourished shoots of the season that spring from the base of stumps where the trees have been felled, I have for years observed it in all its phases, and studied its many curious transitions. These I have described, and have figured some of them in the papers mentioned, to which I would respectfully refer the reader.

In the original paper which I read before the Biological Society of Washington on February 20, 1886, I exhibited some forms that better illustrate the phenomenon than any that have been published. One of these I had figured, and sent the drawing, together with others and the paper itself, to one of the editors of the AMERICAN NATURALIST, at his request, for publication in that journal; but unfortunately it did not appear, owing to a change that took place in the publishers of the NATURALIST just at that time, in the course of which my manuscript was mislaid and could not be found. It has recently come to light and been returned to me, and I am able to introduce here (Fig. 2) the figure in question.

In view of the importance of the basilar expansions above mentioned, and of the fact that Professor Jankó excludes such forms as *P. nobilis* from the genus Platanus, I may perhaps be permitted, at the risk of some repetition of what has been said in my previous

paper, to introduce here that part of my original paper relating to these forms, inasmuch as I there dwelt upon them considerably more at length.

"Few as are the living representatives of this genus, it is now known that the type played an important rôle in later geologic time. More than twenty fossil species have been described, the greater part of which are from North American or Arctic strata. The American forms mostly occur in what is called the Laramie group, which all agree to place very near the boundary line between the Cretaceous and the Tertiary formations. The European, Arctic, and many of our western forms agree well enough with living species to leave no room for doubt as to their generic affinities, but in the Laramie group there occur some aberrant forms which have led to serious difficulties. The most notable of these is the *Platanus nobilis* of Newberry, from the Fort Union deposits. Our knowledge of this species is as yet confined to what we have been able to derive from the study of a large number of very fine leaf impressions. The leaves differ in some important respects from those of any living species of Platanus. They are usually very large, often measuring over a foot in length and width, and instead of having numerous short pointed lobes with broad sinuses, they have only three, or at most five, lobes, which are large and separated by acute sinuses, the margins being entire, or only slightly undulate-toothed. These characters give them much the aspect of many species of Aralia, and they possess other points of resemblance to that genus. They also have the general form of the three-lobed leaves of sassafras. Among the numerous specimens of this type collected by me on the Lower Yellowstone, in 1883, there is great variety in size, coupled with marked uniformity of shape and nervation. The smaller specimens agree in all essential respects with the *Aralia notata* of Lesquereux (Tertiary Flora, p. 237, Pl. XXXIX., Figs. 2-4), from Colorado and Wyoming, which he first called *Platanus dubia* (Hayden's Annual Report, 1873, p. 406) [Fig. 1 of my former paper (Proc. Nat. Mus., Vol. XI., 1888, Pl. XVII.)].

"In immediate association with *Platanus nobilis*, and perhaps merely as a state of it, there occurred a form differing chiefly in

the possession of a very remarkable appendage at the base of the blade. This appendage seems to constitute a miniature reflex of the leaf itself, projected backward over the petiole as a lobate expansion. It is palmately nerved like the principal blade, the primary nerves entering the lobes. These sometimes differ in number from those of the leaf, amounting to six in two of my specimens. They also vary considerably in length and shape. [See Figs. 2-5 of the paper last cited.]

"This basilar appendage is extremely interesting. It is not stipular, since it arises from the summit of a petiole of considerable length, six centimetres of it being preserved in one specimen without showing the attachment. Neither is it bracteal, and there seems no way but to regard it as a veritable part of the main blade, to which it is joined by a broad neck of parenchymatous tissue.

"There is good reason to regard this character as an argument in favor of referring these leaves to Platanus rather than to Aralia or any other genus. The leaves of Platanus have a tendency to produce appendages of various kinds. A good illustration of this is seen in the interesting *P. appendiculata* Lx., from the auriferous gravels of the Sierra Nevadas [Fig. 8 of that paper], where the generic affinities are not at all in doubt. But here the appendages appear to be stipular, though large and quite near to the base of the limb. In the sycamore of this country the stipules are prominent, and often lobed and nerved much like these appendages. They also often appear at the base of young branches bearing several leaves which are likewise provided with true stipules of the same form. In addition to this, however, there sometimes occurs a true basilar lobe or wing-like expansion on the leaf itself, which in the more marked examples very closely resembles those of the fossil impressions described. [Fig. 2 of the present paper represents such a case, and also shows the stipules as they are often produced.] Long before I had seen the fossil leaves I had remarked this tendency in *P. occidentalis* to develop such basilar appendages, and I had collected and preserved specimens of the leaves that bore them to illustrate this peculiarity.

"A careful study of these expansions leaves no doubt of their strict homology with those so much more prominently shown in the extinct form, and the conclusion is at least natural that they are the surviving vestiges of a once prevalent organ.

"Assuming the fossil form to be distinct from *P. nobilis*, which is, however, by no means certain, I have ventured to name it from the peculiar character above described, and to call it *P. basilobata*."

The close relationship of *P. basilobata* to *P. nobilis* renders it obvious that the two must stand or fall together as representatives or ancestors of the genus Platanus. Moreover, it would seem that if they are to be excluded the whole series of ancient types to which they belong, must be removed from the ancestral line of descent of the surviving forms. It appears, therefore, to be essential to the argument that the question whether they belong to this line be settled at the outset. We will, therefore, consider Professor Jankó's objections to the platanoid nature of *P. nobilis*. These are, first, that "It has five thick primary nerves (in a geological period in which this character is wanting in all), and from these very many (16-18) strong secondaries proceed parallel to one another without ending in teeth, their ends, however, reaching the margin of the blade; moreover, these secondaries are well developed to the base of the primaries, which does not occur in the corresponding forms of Platanus." In the second place, "The leaf is five-lobed at the beginning of a geological period in which this form does not occur in the planes; moreover, the lobes are very well developed and large, the depth of the sinuses is of the third degree, although this depth does not appear until the end of the Miocene, and is not characteristic even in the Pliocene." Finally, he objects that "The margin of the leaf of *P. nobilis* is undulating and not toothed; whereas, in the planes in which the nervation is developed as it is in that species, either teeth appear, or the margin is entire, in which latter case the secondaries converge over one another."

In reading these statements one naturally wonders from what source Professor Jankó has derived his knowledge of this species. The chief objection seems to be that the leaves are five-lobed,

with three lateral primaries. This is not at all the case. The original figure of Dr. Newberry (Illustrations of Cretaceous and Tertiary Plants, Pl. XVII.) shows at most only four lobes, and one of these is produced by an abnormally strengthened secondary arising out of one of the lateral primaries. In Dr. Newberry's description (Later Extinct Floras of North America, Ann. Lyc. Nat. Hist., Vol. IX., p. 67) he says: "Leaves . . . three-lobed, or sub-five-lobed, . . . two basilar nerves of nearly equal length and strength," etc.; and speaking of the secondaries arising from the lateral primaries: "The second or third one on each side is often much the strongest of the series, and is then prolonged into a small but distinct lateral, triangular, acute lobe, giving the leaf a somewhat pentagonal form." He figured only one of the leaves in his collection in which, as above stated, this strong secondary and supplementary lobe occur only on one side. From his description it is inferred that although this sometimes may occur on both sides, it is more frequently wanting entirely, and the leaves are simply three-lobed. They never have more than three primary nerves.

The large specimen figured by mē (Types of the Laramie Flora, Pl. XVI.) is of this latter form, and the greater number of my specimens, and of all those seen by me (amounting to hundreds), belong to this class. It is, therefore, safe to say that *P. nobilis* has essentially a palmately three-lobed leaf with two lateral primaries.

So much for the general form. Next, with regard to the margins and the disposition of the secondaries. It is true that in Dr. Newberry's figure (the specimen I have not seen) the secondaries pass directly to the margin, and each one enters a very short, broad, and obtuse tooth, giving the margin an undulate rather than a dentate character. But this undoubtedly varies in different specimens, for he describes the secondaries as "terminating in the teeth of the margin." In my specimens there is the greatest diversity in the margins and in the behavior of the secondaries on approaching them. In the one figured in the "Types," these do not generally differ from Dr. Newberry's, although the secondaries are not all straight or parallel. But I

have other specimens, which will be published in my "Monograph of the Flora of the Laramie Group," in which there are all the variations from a sharply toothed margin with the secondaries entering the teeth, to an entire margin with the ends of the secondaries curving and arching over one another (camptodrome). Moreover, these differences sometimes occur in different parts of the same leaf. In my *P. basilobata*, so far as now known, the nervation is always camptodrome, and the leaves strictly three-lobed.

It may be well to point out in this place more specially than I have done hitherto that the characters last considered not only bear directly upon the ancient forms of the Cretaceous referred to Sassafras or Araliopsis, but also connect themselves with some of the living species, thus strengthening the argument that *P. nobilis* and *P. basilobata* form a sort of connecting link between these. Leaves of *P. racemosa*, for example, sometimes have very much the same form and general nervation of *P. nobilis*. Fig. 3 represents such a leaf now in the National Herbarium, even showing the one strengthened secondary producing a lobe similar to that of Dr. Newberry's figure. Otherwise it is true that the secondary nerves are different, but they are approached in some forms of *P. basilobata*.

On the other hand, there is much variation in these respects among the Cretaceous forms referred by Lesquereux and Newberry to Sassafras. The margins of the lobes are generally entire, as in the leaf which I reproduced from the Cretaceous Flora (Pl. XII., Fig. 2, of the former paper); but there are others, as, for example, that shown in Fig. 4 of the present paper, reproduced from Pl. XI., Fig. 1, of the same work, in which several of the outer secondaries terminate in teeth precisely as they do in *P. nobilis*.

It remains to consider Professor Jankó's argument from the geological history and distribution of the fossil species. This is the weakest part of his paper, as the ancient forms are so largely American, and American geology is so little understood in Europe. So far as fossil plants are concerned, it is chiefly known to Europeans through the works of Lesquereux, who never pre-

tended to be a geologist, and was led by the resemblance in the fossil floras, without taking account of other kinds of evidence, to place most American plant-bearing deposits too high in the series. Why, for example, should Europeans continue to follow Lesquereux in calling the Laramie group Tertiary, when King, Hague, Emmons, Powell, Cope, Marsh, and almost everybody else, have always called it Cretaceous? Moreover, I have shown in my "Synopsis of the Flora of the Laramie Group," published in the Sixth Annual Report of the U. S. Geological Survey, that the evidence of the fossil plants does not necessarily conflict with the latter view, and that the idea that it does so conflict arises from two causes: First, lack of attention to the character of the Upper Cretaceous floras already known; and secondly, the all embracing predominance of the Miocene flora of Europe, in which it is possible to find surviving types of the Cretaceous flora, and, indeed, almost anything that it is desired to find.

Again, Professor Jankó does not seem to be aware that most or all of the Tertiary plant-bearing deposits of the Arctic and sub-Arctic regions which Heer classed as Miocene are regarded as Eocene by those who are now chiefly devoted to their study. Heer's fallacy was also two-fold. Not only was he led astray by the abundance of the Miocene flora to which, as developed in Switzerland, he had devoted so much of his life, but he also failed to make sufficient allowance for the effect of high latitude in causing a flora to appear more recent than it is, as has been chiefly pointed out by Gardner.

The geological distribution of the fossil species according to Jankó, employing his own nomenclature with its exclusions, is as follows:

Cretaceous.—*P. primæva, primæva heerii,* and *newberryana.*

Eocene.—*P. rhomboidea, raynoldsii, haydenii,* and *gulielmæ.*

Miocene and Pliocene.—*P. aceroides, aceroides academiæ, aceroides dissecta, gulielmæ,* and *marginata.*

He does not specify localities, and thus leaves the botanical reader to infer that all these statements are of equal geological weight, which is far from being the case. In fact, for reasons already given and many others, a large part of the whole argu-

ment from geology is erroneous. Let us look closely for a moment at the real geological and geographical distribution of the fossil species of Platanus, especially the American species.

P. primæva Lx., is correctly referred to the Cretaceous, as it occurs only in the Dakota group of the United States.

P. primæva heerii Jankó (*P. heerii* Lx.) is also primarily a Dakota group species, but occurs in the Mill Creek series of Canada and in the Atane beds of Greenland, both of which are considered equivalent to the Cenomanian of Europe, and therefore not greatly different in age from the Dakota group. But I found a form at Black Buttes in the typical Laramie which I referred to that species, admitting some differences. Professor Lesquereux, who was very tenacious of his views as to the Tertiary age of the Laramie, challenged, in a letter, my determination, and I am not quite certain that it is correct. It may be as near to another Cretaceous species, *P. newberryana*, but it is not near to any Tertiary species. But *P. heerii* is not confined to the Cretaceous and Laramie if Gardner is right in reporting it from the Island of Mull at Ardtun, the Eocene age of that celebrated deposit being well established. On this point, however, there are doubts, as he only provisionally identifies the *Platanites* of Forbes with that species.

P. newberryana Heer, the other Cretaceous species, is, like the rest, a typical Dakota group form, and has not been found outside the Cretaceous, nor, indeed, outside the Dakota group, except in the Patoot beds of Greenland, which, however, are considerably higher in the series, being referred by Heer to the Senonian.

So much for the Cretaceous species. Next as to the alleged Eocene ones.

P. rhomboidea Lx. is only known in two specimens from Golden, Colorado. An examination of the specimens themselves shows that they are from the so-called tufa beds of South Table Mountain, and therefore belong to the Denver formation of Emmons, which he places somewhat higher than the Laramie. It may therefore pass as Eocene.

P. raynoldsii Newberry was originally described from the Fort Union group on the Missouri and Yellowstone Rivers, and I

found it in the Yellowstone Valley in 1883. The Canadian geologists report it from numerous points in what they call Laramie in the Northwest Territory, which I believe to be nearly or quite the same as the Fort Union group. As Dr. Newberry is not willing to admit the Laramie age of this group, and inclines to regard it as Tertiary, this may also pass as an Eocene species. It is not, however, strictly confined to the Eocene, for it has recently been found in a collection from the John Day River, Oregon, a Tertiary deposit that is generally placed near the top of that system as Pliocene or extreme upper Miocene. On the other hand, the variety *integrifolia* Lx. is a Laramie form from Black Buttes and Golden, and is therefore Cretaceous.

P. haydenii Newberry has very much the same range as the last, chiefly Fort Union group and Canadian Laramie, but it has not been found higher, and has been reported from certain doubtful deposits, such as Carbon, Medicine Bow, and Washakie, in Wyoming. It also occurs at Golden, and is said to be found in the typical Laramie of the Raton Mountains.

P. gulielmæ Göpp. is a well-known and widely distributed species of the European Miocene, also abundant in all the Arctic Tertiaries. Nathorst finds it in the Upper Tertiary of Japan, and it is by no means rare in the American deposits, being reported from Carbon, Washakie, Separation, Medicine Bow, Junction Station, etc., in Wyoming, perhaps Lower Tertiary; from Golden, probably Denver formation; and with less certainty from Black Buttes and the Raton Mountains, true Laramie. I collected it on the Lower Yellowstone, Fort Union group, and Lesquereux identified it in a collection from Mansfield, Louisiana (Mississippi Tertiary). It therefore appears to originate in the Upper Cretaceous.

Finally the Miocene and Pliocene species are.

P. aceroides (Göpp.) Heer. This is the most abundant of all fossil planes, and, accepting Professor Jankó's synonymy, is extremely variable. It is doubtless the immediate ancestor of all the living species, but it is not an exclusively Miocene and Pliocene species, as it occurs abundantly throughout the Arctic

Tertiaries, and in the Fort Union group and other deposits in the United States that are below the Green River group, and have been sometimes regarded as Laramie. If Tertiary at all, they belong at the very base of that series. Specimens have even been collected in the Bozeman coal mines, which Dr. Peale, who has devoted many years to their study, regards as Cretaceous. In the form of *Acer trilobatum*, which Lesquereux did not consider a Platanus, it also occurs in the Green River group on Troublesome Creek, Colorado, generally regarded as Eocene. It, therefore, doubtless also had its origin in the Cretaceous of America.

P. aceroides academiæ Jankó (*P. academiæ* Gaudin) is only known from the Upper Miocene deposit of Montemasso, Italy, and has no importance.

P. aceroides dissecta Jankó, including *P. dissecta* Lx., and *P. appendiculata* Lx., is confined, so far as now known, to the Upper Tertiary (Pliocene or Quaternary) of California (Chalk Bluff, Corral Hollow, Spanish Peak, Toulumne and Nevada Counties). The latter form, as I have shown, approaches very closely the American sycamore, *P. occidentalis*, and connects it by its basilar appendage with *P. basilobata* of the Fort Union group.

P. marginata (Lx.) Heer (*Viburnum marginatum* Lx.), the last species to be considered, is primarily a typical Laramie (Bitter Creek) species, but also occurs in the Denver formation at Golden, Colorado. Like so many other Laramie species, it is found in the Tertiary deposits of Greenland, where Heer first discovered its platanoid character. It is, therefore, not a Miocene species at all, but a Cretaceous species extending into the Eocene.

This hasty review enables us to revise the geological distribution of the fossil species of Platanus given by Professor Jankó, which should therefore stand as follows:

I. Exclusively Cretaceous species.—*P. newberryana* and *primæva*.

II. Species originating in the Cretaceous, but extending into the Tertiary.—*P. primæva heeri*, *marginatum*, and *raynoldsii integrifolium*.

III. Species originating in the Eocene.—*P. aceroides*, *gulielmæ*, *haydenii*, *raynoldsii*, and *rhomboidea*.

IV. Species not occurring below the Miocene.—*P. aceroides academiæ* and *aceroides dissecta*.

It will be observed that in the above distribution I have not considered the Fort Union group, the Denver formation, nor any of the deposits along the Union Pacific Railroad, except those on Bitter Creek, to be Cretaceous. I have also excluded the Bozeman coal mines containing *P. aceroides*. The radical difference between this distribution and that of Professor Jankó renders needless any discussion of his argument from geological considerations; and although I believe an argument can be based on these considerations, it would require to take into the account the more abnormal and archaic forms which he excludes from the genus. This argument is already stated in my previous papers, and the present one has become too long to admit of its expansion here.

EXPLANATION OF PLATE XXVIII.

FIG. 1.—Leaf of *Platanus orientalis* L., from Washington, D.C. (cult.).

FIG. 2.—Lower portion of a leaf of *Platanus occidentalis* L., showing basilar and stipular appendages, from the District of Columbia.

FIG. 3.—Leaf of *Platanus racemosa* Nutt., from California, collected by Mrs. Austin.

FIG. 4.—*Sassafras cretaceum* Newb., Lesquereux, Cretaceous Flora, Pl. XI., Fig. 1. Dakota group.

PLATE XXVIII.

Platanus species.

RECORD OF AMERICAN ZOOLOGY.

BY J. S. KINGSLEY.

(Continued from Vol. XXIV., page 548.)

IT is the intention to catalogue here in systematic order all papers relating to the Zoology of North America, including the West Indies, beginning with the year 1889. An asterisk indicates that the paper has not been seen by the recorder. Owing to the method of preparation it is impossible to collect in one issue all the papers relating to any group, but it is hoped that succeeding numbers will correct this. Authors are requested to send copies of their papers to J. S. Kingsley, Lincoln, Nebraska.

GENERAL.

RILEY, C. V.—On the causes of variation in organic forms. Proc. A. A. A. S., XXXVIII., p. 225, 1889.

COCKERELL, T. D. A.—On the citation of localities. *Can. Ent.*, XXI., p. 46, 1889.

HOUGH, W.—The preservation of museum specimens from insects and the effects of dampness. Rep. U. S. Nat. Mus., 1886–7, p. 549, 1889.

HERRICK, F. H.—Walks under the sea by a coral strand. AM. NAT., XXIII., p. 941, 1889 [1890].

COPE, E. D.—The Silver Lake of Oregon and its region. AM. NAT., XXIII., p. 970.

RYDER, J. A.—The acquisition and loss of food-yolk, and the origin of the calcareous egg-shell. AM. NAT., XXIII., p. 928, 1889 [1890].

PROTOZOA.

STOKES, A. C.—Notices of new Peritrichous Infusoria from the fresh waters of the United States. *Jour. Roy. Micros. Soc.*, 1889, p. 477, 1 pl.—Describes as new *Epistylis vittata*, *E. elongata*, *E.*

autumnalis, E. ramosa, Pyxidium nutans, Vorticella conosoma, V. conochili, V. molesta, Opisthostyla globularis, O. similis, Halsis [nov. gen.] *furcata.* As in all of Dr. Stokes's papers, no localities are given.

SPONGES.

* Von Lendenfeld, R.—A monograph of the horny sponges. London Royal Society, 1889.—Describes 56 species from the Atlantic coasts of North America, of which 29 also occur in Australia.

Fewkes, J. W.—Rosella in shallow water near Monterey, Cal. Proc. Boston Soc., XXIV., p. 45, 1889.

CŒLENTERATA.

Fewkes, J. W.—On a method of defense among certain medusæ. Proc. Bost. Soc., XXIV., p. 200, 1889.

Von Lendenfeld, R.—Neuere Untersuchungen über Polypomedusen. *Biol. Centralbl.*, IX., p. 47, 1889.—Abstracts of papers by Brooks, H. V. Wilson, Fewkes, *et al.*

Nutting, C. C.—Contribution to the anatomy of Gorgonidæ. Bull. Lab. Nat. Hist., State Univ. of Iowa, I., p. 97, 10 pls., 1889. —A general account.

Fewkes, J. W.—New invertebrata from the coast of California. Bull. Essex Inst., XXI.. p. 99, 8 pls., 1889 [1890].—Describes as new *Syncoryne occidentalis, Campanularia occidentalis, Atractylodes* [n. g.] *formosa, Perigonimus formosus, Steenstrupia occidentalis, Willia occidentalis, Microcampana* [n. g.] *conica, Velella meridionalis, Athorybia californica, Sphæronectes gigantea, Bunodes californica, Anemonia stimpsonii;* and gives notes on *Syncoryne rosaria, Polyorchis penicillata, Chrysaora melanaster, Aurelia labiata, Pelagia panopyra.*

——The anatomy of *Astrangia danæ.* 20 pp., Washington, 1889.—Six plates drawn by Sonrel in 1849. Explanation by Fewkes. Published by Smithsonian Institution.

——On a new Athorybia. *Ann. and Mag. Nat. Hist.*, III., p. 207.—*A. californica.*

——On Angelopsis and its relationship to certain Siphonophora, *ibid*, 1889.

ECHINODERMATA.

IVES, J. E.—On a new genus and two new species of Ophiurans. Proc. Phila. Acad., 1889, p. 143.—*Ophiocrinus granulosus* and *Ophioglypha lockingtonii*, from the Pacific coast of America.

——Catalogue of the Asteroidea and Ophiuroidea in the collection of the Academy of Natural Sciences of Philadelphia, *l. c.*, 1889, p. 169.—Contains some new localities.

FEWKES, J. W.—On the serial relationship of the ambulacral and adambulacral calcareous plates of the star-fishes. Proc. Bost. Soc., XXIV., p. 96, 1889.

——New invertebrata from the coast of California. Bull. Essex Inst., XXI., p. 99, 7 pls., 1889 [1890].—Notes on *Dermasterias imbricata* and *Ophiothrix rudis.*

PLATHELMINTHES.

LINTON, EDWIN.—Notes on cestoid entozoa of marine fishes. *Am. Jour. Sci. and Arts*, XXXVII., p. 239, 1889.—Abstract of forthcoming paper.

STEDMAN, J. M.—Researches on the anatomy of *Amphistomum fabaceum* Diesing. Proc. Am. Soc. Micros., XI., p. 85, 3 pls., 1889.—A histological account of this parasite of the manatee.

ANNELIDS.

FEWKES, J. W.—New invertebrata from California. Bull. Essex Inst., XXI., p. 130, 1889 [1890].—Describes as new *Sabellaria californica, Sabella pacifica, Spio californica.*

MARSH, C. D.—A two-tailed earthworm. AM. NAT., XXIV., p. 373, 1890.

PROSOPYGII.

FEWKES, J. W.—New invertebrata from California. Bull. Essex Inst., XXI., p. 135, 1889 [1890].—Describes as new *Ascorhiza occidentalis* (vide infra).

——A preliminary notice of a stalked Bryozoan (*Ascorhiza occidentalis*). *Ann. and Mag. Nat. Hist.*, III., p. 1, 1889.

HINCKS, T.—The Polyzoa of the St. Lawrence: a study of Arctic forms. *Ann. and Mag. Nat. Hist.*, III., p. 424, 1889.

DALL, WM. H.—A preliminary catalogue of the shell-bearing marine mollusks and brachiopods of the southeastern coast of the United States. Bull. U. S. Nat. Mus., No. 37, 1889.—Enumerates 21 forms.

——Preliminary report on the collection of Mollusca and Brachiopoda obtained [by the U. S. Fish Commission steamer Albatross] in 1887-8. Proc U. S. Nat. Mus., XII., p. 219, 1889 [1890].—See AM. NAT., XXIV.

ROLFE, C. W.—Characters and distribution of the genera of Brachiopods. AM. NAT., XXIII., p. 983, 1889 [1890].

VERMES, INCERTÆ SEDIS.

ZELINKA, C.—Die Gastrotrichen. *Zeit. wiss. Zool.*, XLIX., p. 209, 1889.—See AM. NAT., XXIII., p. 912.

MOLLUSCA.

FORD, JOHN.—Remarks on *Oliva inflata* [etc.]. Proc. Phila. Acad., 1889, p. 137.—On the variation of the Olivas.

DALL, W. H.—On the hinge of the Pelecypods and its development, with an attempt toward a better subdivision of the group. *Am. Jour. Sci. and Arts*, XXXVIII., p. 444, 1889.—Criticises existing classifications of Lamellibranchs, and proposes one based primarily on hinge structure. Vide AM. NAT., Dec. 1889.

FORD, J.—Notes on Crepidula. Proc. A. N. S., Phila., 1889, p. 345, 1890.—Maintains specific validity of *C. glauca*.

SHARP, B.—Activity in *Donax*. Proc. A. N. S., 1889, p. 347, 1890.

PILLSBRY, H. A.—New and little-known American Mollusks, II. Proc. A. N. S., Phila., 1889, p. 411, 1890.—Describes as new *Pupa calamitosa* (Cal. and Lower Cal.), *P. sterkiana* (L. Cal.), *Zonites simpsoni* (Ind. Ter.), *Z. selenitoides* (Cal.), *Helix* (*Hemitrochus*) *streatori* (West Indies), *Pupa holzingeri* Sterki (Iowa, Minn.).

DALL, W. H.—Preliminary report on the collection of Mollusca and Brachiopoda obtained [by the U. S. Fish Commission steamer Albatross] in 1887–8. Proc. U. S. Nat. Mus., XII., p. 219, 1889 [1890].—See AM. NAT., XXIV., p. 582.

HEILPRIN, ANGELO.—On some new species of Mollusca from the Bermuda Islands. Proc. Phila. Acad., 1889, p. 141, 1 pl.—Describes as new *Chama bermudensis, Macoma eborea, Mysia pellucida, Cytherea penistoni, Emarginula dentigera, E. pileum,* and *Cæcum termes.*

PILLSBRY, H. A.—Nomenclature and check-list of North American land shells. Proc. Phila. Acad., p. 191, 1889.—Enumerates 302 species.

DALL, W. H.—Notes on the anatomy of *Pholas* (*Barnea*) *costata* Linne., and *Zirphæa crispata* Linne. Proc. Phila. Acad., 1889, p. 274.

WRIGHT, B. H.—A new Florida Bulimulus. *W. A. Scientist,* VI., p. 8.—*B. hemphillii.*

PECK, J. J.—On the anatomy and histology of *Cymbuliopsis calceola.* Studies Biol. Lab. J. Hopkins Univ., IV., p. 335, 1890.—Describes digestive, nervous, reproductive, excretory, and circulatory organs.

FEWKES, J. W.—New invertebrata from the coast of California. Bull. Essex Inst., XXI., p. 139, 1889 [1890].—Describes as new *Cabrilla* [n. g.] *occidentalis,* and gives notes on *Chioræa leontina.*

*VON MARTENS, E.—Eine ausgestorbene Landschnecke von den Bermuda Inseln (*Helex nelsoni* Bland). *Stz. Geo. Natur. Fr.,* Berlin, 1889, p. 201.

*COCKERELL, T. D. A.—Note on *Patula cooperi. Journ. Conch.,* VI., p. 17, 1889.

*SMITH, EDGAR A.—On the Mollusca collected by Mr. G. A. Ramage in the Lesser Antilles. *Ann. and Mag. Nat. Hist.,* III., p. 400, 1889.

*COCKERELL, T. D. A.—Preliminary remarks upon the molluscan fauna of Colorado. *Journ. Conch.,* VI., p. 65, 1889.

——Some notes on Dr. A. R. Wallace's Darwinism. *Nature,* XLI., p. 393, 1890.

DALL, W. H.—A preliminary catalogue of the shell-bearing marine mollusks and brachiopods of the southeastern coast of the United States, with illustrations of many of the species. Bull. U. S. Nat. Mus., No. 37, 1889, pp. 221, pls. 74.—Enumerates 487

Lamellibranchs, 44 Scaphopods, 33 Pteropods, 1127 Gasteropods, and 2 Cephalopods; implying a total molluscan fauna of "at least eighteen hundred forms."

*STEARNS, R. E. C.—Notes and comments on the distribution of *Planorbis bicarinatus*. *West American Scientist*, VI., p. 110, 1889.

STERKI, V. A.—A Study of the American species of Vertigo contained in the U. S. Nat. Mus., with a description of a new sub-genus of Vertigo. Proc. Nat. Mus., XI., p. 369, 1888 [1889]. —New sub-genus Angustula.

NEWLY-DISCOVERED GLACIAL PHENOMENA IN THE BEAVER VALLEY.

BY P. MAX FOSHAY AND R. R. HICE.

AT the mouth of Connoquenessing Creek the valley of the Big Beaver is typically developed. The hills on either side, rising to an elevation of 1200′ + A.T., slope rather gently down to the old base level plain, here at an elevation of 180′+ above the present river level, or 910′ + A.T. This plain marks the level of a system of preglacial drainage at this point, which, as has been heretofore suggested, was probably to the north. The plain is covered with a fine, close, and very tough whitish or yellowish clay, shading away at some points into a mixture of sand and gravel, the pebbles for the most part being well-rounded quartz, in size from one and one-half inches in diameter downward.

Near the middle of this old river valley is a gorge, 200 to 300 yards in width, cut almost perpendicularly into the heavy sandstones, the Homewood and lower members of the Conglomerate series, and reaching to a depth of 125′ + below the present level of the Beaver, having a total depth of 300′ +.

Two or three miles to the north occur great deposits of morainic material,[1] which were supposed to mark the southern limit of glacial action in the Beaver valley.

[1] H. C. Lewis and G. F. Wright, Second Geological Survey of Penna., Vol. Z, p. 194.

At the mouth of the Connoquenessing, and lying upon the old base level plain, are several deposits of stratified gravel, having irregular hummocks, forming in some places small but well-defined kettle-holes; in short, partaking of the characteristics of kames, and apparently overlying the whitish or yellowish clay above mentioned. Lying south of the terminal moraine as heretofore mapped, some doubt was at first raised as to their true character, a doubt since removed by a more careful examination of the largest of them, and the discovery of grooves and striæ on the cliffs of the rock-gorge.[2]

The largest of these deposits is of an "L" shape, with the longer arm lying in the direction of the river valley, and almost a mile in length. It reaches thirty to forty feet above the base level plain, and the top is formed into irregular hummocks, covered with a thin, gravelly soil. The only sections seen showed clear but irregular stratification, and we did not feel sure we saw the junction of the kame and underlying clay at any point. We were informed, however, that, after passing through the gravel, as much as eleven feet of hard, tenacious clay had been penetrated without reaching the rock.

This, the largest deposit, lies on the western side of the river, a little above the mouth of the Connoquenessing. There are other deposits, of essentially the same structure, a mile further south (just north of Clinton Run), and on the eastern side of the river one is seen on the old base level plain of the Connoquenessing, one-fourth mile from the Beaver.

On a close examination of the base of the largest kame, in the search for its junction with the underlying clay, a new feature of glacial action in the Beaver valley was discovered, in a number of grooves and striæ. On its eastern side the gravel reaches at one point to the bluff of the rock-gorge, and the massive rock having been quarried for building purposes, the surface of the sandstone was seen. The top of the gorge is here in the Homewood sandstone, at this point a massive, rather coarse-grained, quartz rock, slightly colored with iron. The

[2] The nearest striæ reported are one-half mile northwest of New Castle. Second Geol. Survey of Penna., Vol. Z, p. 196.

quarry has been but little worked, and the grooves could not be followed for any distance on account of the overlying gravel. The direction of the face of the sandstone is S. S. W., and the grooves and striæ cut the face at an angle of about 60°, their direction being about S. E. by S., practically at right angles to the glacial border. The direction of the old valley is here nearly north and south, hence the grooves and striæ cut the valley at an angle of nearly 45°, and must have ended abruptly on the cliffs of the rock-gorge.

The largest groove is about five feet in width and eighteen inches in depth, the entire surface being striated in the direction of the groove. The smaller grooves lie in the same direction, and the entire surface seen (some forty feet) is uniformly scratched. No indications of cross striation were seen on the rock in place, but on a loose fragment (4′ × 3′) left in quarrying some indications of cross striæ were visible.

Some ten or twelve rods to the south, in another quarry, striæ were also seen, running in the same direction; here they were visible for some fifteen feet. The sandstone at this point is a Conglomerate, the pebbles reaching three-eighths of an inch in diameter. Here the surface is filled with pot-holes, from one to five feet in diameter, and from one to two feet in depth. None were seen entire, all the exposed ones being more or less shattered in quarrying. The pot-holes are not in anywise striated, nor does the striating agent appear to have affected the edges of the holes, which are as sharp as those now forming in similar sandstones. The general appearance of the pot-holes indicates that they were made by a north-flowing stream, and we believe they are older than the striæ, though the evidence is as yet incomplete.

Beaver, Pa., July 29, 1890.

THE DISTRIBUTION OF PLANTS.

BY V. M. SPALDING.

AN unusual degree of interest has recently been manifested, both in the general subject of the geographical distribution of plants, and in the special study of areas occupied by natural groups, with reference to questions of relationship. In view of this interest, indicated in part by various important papers and monographs that have lately appeared, it may be that an outline of the historical development of the subject, and the present condition of our knowledge in regard to it, may serve a timely purpose.

The history of the philosophical study of geographical distribution properly begins, with the opening of the present century, with the classical essay of Alexander von Humboldt on the "Geography of Plants."[1] Fifty years before that time Linnæus[2] had discussed the habitats of plants, with reference to the physical conditions by which they appeared to be determined, and somewhat later had considered the dissemination of seeds by winds and other agencies, and the influence of climate and latitude; but Humboldt was the first to approach this study with the distinctively scientific spirit that subordinates facts to principles, and endeavors to give to all observed phenomena a rational explanation.

Humboldt's habits of study led him to think of the vegetation of the earth from the standpoint of the physical geographer rather than that of the biologist. In the "Ansichten der Natur," published in its final form many years later, the prominence still given to physical conditions, and the fixed habit of deriving conclusions from numerical data, furnish a striking comment

[1] Essai sur la Géographie des Plantes, 1805.

[2] For a brief and discriminating reference to the writings of Linnæus upon the subject, and the still earlier observations of Tournefort, see the address of Sir J. D. Hooker before the Geographical Section of the British Association at the York meeting, 1881, where other important references may also be found.

upon the hopefulness of attaining correct biological conceptions through strictly mathematical processes. He laid down the principle that "the predominance of certain families of plants determines the character of a landscape, and whether the aspect of the country is desolate or luxuriant, or smiling and majestic;" and further, that "the predominance of a particular species, as to the number of individuals,—the mass,—or, on the other hand, the lack of certain species, may give to a region a peculiar physiognomy." Connecting his thought, in the usual way, with man and his welfare, he says: "Grasses forming extended savannahs, or the abundance of fruit-yielding palms, or social coniferous trees, have respectively exerted a powerful influence on the material condition, manners, and character of nations, and on the more or less rapid development of their prosperity."

From this point of view, then, the first thing to be undertaken in the study of the geography of plants was to bring out the conspicuous characteristics of the flora of a given region by determining the number of species of a particular family, as compared with the whole number of species constituting the flora of the region in question. As a single specimen of the laborious comparisons carried out by him may be cited his tabulated statements of the estimated preponderance of various families of plants in the north temperate zone.[3]

It is unnecessary to say that he did not possess, at that time, sufficient data for making such estimates more than approximate. Nor if they had been exact would they have brought out the real principles involved. Humboldt himself seems to have felt this, and to have groped almost painfully after the solution of the problem. "The forms of organic beings," he says, "are reciprocally dependent on one another. Such is the unity of nature, that these forms limit each other in obedience to laws which are probably connected with long periods of time." He anticipated,

[3] The number of species of several conspicuous families were compared with the whole number of species of that zone. Thus:

Glumaceæ, $\frac{1}{4}$.
Compositæ, $\frac{1}{8}$.
Leguminosæ, $\frac{1}{18}$.
Labiatæ, $\frac{1}{24}$.
Umbelliferæ, $\frac{1}{40}$.
Amentaceæ, $\frac{1}{45}$.
Cruciferæ, $\frac{1}{19}$.

in some measure, the results of later investigations; but even his extraordinary genius, that seemed to compass the whole earth in its giant grasp, was forced at last, baffled and eluded, to yield the question and leave the field.

Humboldt's real service, then, was not so much in developing the laws of distribution as in boldly stating the problem and showing more clearly than it had ever been shown before how much there was to be accounted for. It needs but a slight acquaintance with his writings to feel convinced that the whole subject of distribution had scarcely been worked beneath the surface; the lines had been sighted and the stakes driven, but deeper explorations were left for future workers.

The well-known treatise of Alphonse De Candolle, "The Géographie Botanique Raisonnée," [4] appeared just half a century after the publication of Humboldt's essay. It is hardly too much to say that, compared with all that had preceded it, this great work showed such an increase of knowledge, with a breadth of view and capacity for generalization, as rendered it a permanent record of the sum total that had been accomplished up to the middle of the present century in this study.

An examination of De Candolle's treatise shows that there were, at that time, clear ideas regarding the relations of plants to physical conditions; that the shape of the area occupied by a species —approximately circular or elliptical—had been noticed; and disjoined species—those occupying widely separate areas—had received a certain amount of attention; that the greater part of existing species were then, as now, held to be of high geological antiquity, although it was also held that they originated by successive creations; and finally that the relations of species to genera, families, and higher groups were beginning to be studied in the light of facts of distribution.

De Candolle had fairly done what, at this time, lay within the power of man to do. He had gathered an overwhelming array of facts, had marshalled them with orderly precision, had tried them—not wholly satisfactorily, it is true—with reference to their theoretical bearing, and had given them to the world ready to use.

[4] Paris, 1855.

But there was still needed some great fundamental conception to bind these facts together into a consistent whole; and this conception, brought out three years later in the famous papers of Wallace and Darwin before the Linnæan Society, was embodied and applied, more and more completely, in the various monographs and essays of the three botanists: Asa Gray in the United States, and J. D. Hooker and George Bentham in England.

The history of the subject now becomes so largely identical with the contributions of these three men[5] that we can do no better than to follow each one of them step by step in his work, and see, as far as we are able, the facts as they saw and interpreted them.

The botanical contributions of Asa Gray, taken as a whole for fifty years, bore more or less directly upon the subject of geographical distribution. One of his earliest reviews is a notice of Siebold's Flora Japanica,[6] in the course of which the remark is made that "the flora of Japan presents such striking analogies to that of the temperate part of North America as to render this work of more than ordinary interest to American botanists;" and again, in 1846, he takes the occasion offered in another review to say: "It is interesting to remark how many of our characteristic genera are represented in Japan, not to speak of striking analogous forms."

This remarkable fact, having once been clearly formulated, was never lost sight of, and although it seemed incapable of explanation upon any theory then held regarding the nature of species, Dr. Gray lived long enough to find the clue to its meaning, and to show the far-reaching and fundamental nature of the principle involved.

[5] All mention of such works as those of Schoua and Griesbach, however valuable for their statement of facts, has purposely been omitted. The service rendered by those who collect data exhaustively and accurately is by no means called in question, but it does not fall within the purpose of the present sketch to consider any treatises, however extended, that cannot be shown to have definitely contributed to a better comprehension of the principles in this study. For an entirely different reason, it has been thought best to omit any discussion of the well-known papers of Forbes and Darwin, although the former was called by Hooker "the reformer," and the latter "the greatest lawgiver," of the science of geographical distribution.

[6] *Am. Jour. Sci.*, Oct., 1840.

In 1856 and '57 Dr. Gray published in the *American Journal of Science* a continued article on the Statistics of the Flora of the Northern United States,[7] in which facts in line with those already indicated were brought out at much greater length, statistical comparisons being made between the numbers of orders, genera, and species indigenous to the Northern United States and those of Europe and Eastern Asia respectively; the close relationship of the floras of the two great continents again being brought out in a still more striking manner. His remarks on the theoretical bearing of these facts are of special interest from having appeared some little time before the "Origin of Species." Dr. Gray says: "As the discussion of this most difficult problem proceeds, the two antagonistic positions only appear to be tenable. . . . . The first theory is based upon the natural idea of species as consisting of kindred individuals descended from a common stock which, whether demonstrable or not as a fact, gives us a clear and distinct conception of species, and the only one we possess, The second theory, being incompatible with this conception, leaves species no objective basis in nature and seems to make even the ground of their limitation a matter of individual opinion."

Here was the essential conception of the real nature of species, —a conception that became more fixed as his studies continued, and was expressed more at length in a memoir presented to the American Academy in 1858–'59,[8] in which Dr. Gray says: "The natural supposition is that individuals of the same kind are descendants from a common stock, or have spread from a common center; and the progress of investigation, instead of eliminating this preconception from the minds of botanists, has rather confirmed it."

Without attempting to condense or reproduce further the substance of these earlier papers, it is enough to say that in them had already been clearly formulated two essential principles, viz., the genetic relationship of plants of the same and "representative" species, and repeated migrations under changed climatic

[7] *Am. Jour. Sci.*, 2d Ser., Vol. XXII. (1856), and Vol. XXIII. (1857).

[8] Memoirs Am. Acad., New Ser., Vol. VI.

conditions. His later papers[9] extend and confirm the observations recorded in these; and the fact that the accumulations and research of nearly thirty years afterwards did not change his views in any essential particular is of importance. The history of the big trees of California, of the forests of the Northern Continents, and the peculiarities and resemblance of the North American flora as compared with those of Europe and Asia, still were shown to point unmistakably to migrations from a former common, though extended, area, with subsequent modifications in accordance with the theory of descent.

Dr. Hooker covered a different ground in his study of geographical distribution. Taking up successively the Antarctic flora, and those of New Zealand, Tasmania, and the Oceanic Islands, it was only at a later period in his investigations of the floras of Southern Asia and of the Arctic regions that he overlapped in any way the ground already occupied by Dr. Gray.

His position in regard to theories then prominent was distinctly indicated in the "Introductory Essay to the Flora of Tasmania."[10] Referring to the flora of New Zealand,[11] in which he had given (though without distinctly endorsing) the prevalent view, that species are created as such, he says: "In the present essay I shall advance the opposite hypothesis, that species are derivative and unstable."

Of the observed facts recorded in this series of monographs only a few of the most important can be mentioned.

It was shown in the Flora Antarctica that a certain relationship exists between floras of the Antarctic Islands and that of the ex-

[9] Three papers of Professor Gray contain his latest contributions to this subject, and represent his mature views and final judgment regarding the distribution of plants in the Northern Hemisphere. These are:

1. Sequoia and its History: The Relations of North American to Northeast Asian and to Tertiary Vegetation. A presidential address to the American Association at Dubuque, August, 1872.

2. Forest Geography and Archeology. A lecture delivered before the Harvard University Natural History Society, April, 1878.

3. Characteristics of the North American Flora. An address to the botanists of the British Association at Montreal, August, 1884.

[10] *Am. Jour. Sci.*, 1860, Vol. XXIX.

[11] Reviewed in *Am. Jour. Sci.*, 1854, Vol. XVII.

treme southern portion of the American continent, and subsequent study brought out a far greater extension of this relationship.

A further interesting observation was that the plants of the Antarctic Islands that are also natives of Tasmania, New Zealand, and South America, are almost invariably found only on the lofty mountains of those countries.

In view of these and other results, Dr. Hooker was strongly impressed with the view that existing agencies are not sufficient to account for the observed facts, and concludes that these floras "exhibit a botanical relationship as strong as that which prevails throughout the land within the Arctic and Northern Temperate zones, and which is not to be accounted for by any theory of transport or variation, but which is agreeable to the hypothesis of all being members of a once more extensive flora, which has been broken up by geological and climatic causes."

In the "Outlines of the Distribution of Arctic Plants," published in 1861, an attempt was made to trace the distribution of every phænogamous species known to occur spontaneously within the Arctic circle. The distinctively Scandinavian character of the Arctic flora, the remarkable deficiency of Greenland in characteristically American species, and the fact that no close relation was discovered between the isothermal lines and the amount of vegetation, so that the observed facts remained to be accounted for in some other way than by reference to present climatic conditions, were some of the most important results of this study. The explanation offered involved the two principles already established by Dr. Gray, viz., the community of origin of closely related species, and forced migrations under the influence of climatic changes.

The results of Dr. Hooker's study of insular floras were embodied in a paper presented to the British Association at its Nottingham meeting in 1866.[12] It contained the most extended account that has yet been given of island life from the strictly botanical point of view. The author emphasizes the fact that the flora of no oceanic island is independent and *sui generis*, but is always very manifestly allied to some continental flora; but that they all

[12] Translated in the *Ann. des Sci. Nat.*, Sér. V., Tom. 6.

have numerous and very remarkable species peculiar to them, and which distinguish them from the continental islands. He discusses at length the possibility of transoceanic communication, and although still impressed with the difficulty of accounting for the distribution of plants on oceanic islands by reference to agencies now in operation, he is far less inclined to deny that these may be sufficient than in his discussion of the floras of New Zealand and Tasmania. In fact, he seems ready to admit the full force of the argument, as recently stated by Wallace, for their distribution by natural agencies now acting, although there were still certain difficulties that did not seem to him to readily yield themselves to such an explanation.

Hooker's extended and long-continued study of the distribution of plants in every part of the Eastern hemisphere had led him to essentially the same conclusions as those reached by Dr. Gray. Both had come perforce to think of species as unstable, and both, while recognizing to the full extent the action of existing agencies of dispersal, had felt the necessity of assuming the action of climatic changes antedating the present geological epoch, the results of these changes being in a good degree definite and ascertainable in the Northern hemisphere, less definite and more perplexing in the Southern.

The most voluminous writer, and the one who has perhaps done the most, taken all in all, to advance our knowledge of the distribution of plants, was George Bentham, who for fifty-seven years, ending with his death in 1883, contrived to produce, one after another, floras, monographs, and other botanical papers, until even a review of them become a herculean task.

He approached the subject differently from either Gray or Hooker. Finally recognizing, equally with them, the importance of the theory of descent as an essential factor, he undertook to apply this by a laborious and exhaustive comparison of botanical characters and actual geographical location of species, genera, and sub-orders. "If," he says, "the two theories be admitted, that allied species and genera have a common origin, and that the descendants of a common stock placed in different regions having no inter-communication will vary in these different regions

with different combinations of characters, it will be seen how much geographical distribution may be made to check the value given to generic or other groups founded upon technical distinctions." In other words, he inaugurated the actual use of facts of geographical distribution as an aid to classification.[13]

The method pursued by Gray and Hooker in determining the species that occupy a given region, and comparing this region botanically with others, brings the geographical side of the question into prominence; and in the hands of botanists conversant with the principles of physical geography it has served to furnish important evidence bearing upon questions that are properly of a geological nature. Bentham's method, on the other hand, consisting in the exhaustive study of various families of plants, with the distribution of each of their species, as far as this is known, the world over, suggests greater possibilities than the former, inasmuch as it offers at least the hope of one being able some time to follow, step by step, the descendants of a common ancestor as they have spread themselves over the face of the earth. Such monographs as those of Bentham's on the Campanulaceæ [14] and Compositæ [15] are excellent specimens of what has already been accomplished in this direction, and if they are somewhat disappointing in coupling few conclusions with enormous labor, they point out none the less the way in which those who care to lay solid foundations for future studies of this kind will probably choose to work.

Thus far it has been attempted rather to indicate the successive steps that have been taken in this line of investigation since the time it became a subject of scientific inquiry, rather than to discuss results and theories. If, now, a brief summary of the present status as a whole is made, it appears, in the first place, that the observed facts relating to the distribution of plants correspond in every essential respect with what has been observed of the

[13] The results of Bentham's studies up to 1869 are epitomized in the presidential address of that year to the Linnæan Society (translated in the *Ann. des Sci. Nat.*, Sér. V., Tom. XI.), and are summarized by Prof. W. T. Dyer in the article "Distribution;" in the Encyclopedia Britannica.

[14] *Jour. Linn. Soc.*, Vol. XIII.

[15] Ibid., Vol. XV.

geographical distribution of animals. Making allowance for the greater age of plant life and the facility with which seeds are carried over barriers not easily crossed by animals, it is plain that the same laws have governed in the one case as in the other.

In the second place, although the theory of dispersal of each species from a single centre, occupied by its own ancestral form, has been found to harmonize better with the facts thus far observed than any other, the application of this principle, simple and intelligible in itself, is beset with practical difficulties, owing to the complicated relations of the various agencies involved.

It seems perfectly plain, for example, that changes of climatic conditions have had much to do with the present distribution of plants in both hemispheres, but just how much it is hard to tell; and, in the same way, the extent to which ordinary means of dispersal, such as wind, water, etc., have operated can hardly be determined with precision.

To illustrate: when we find in Eastern Asia our own gold-thread, blue cohosh, twin-leaf and mandrake, poison ivy and prickley ash, Mayflower, snowberry, partridge-berry, and a host of other either identical or equivalent species, and find all these absent from Europe, we feel no hesitation in taking these facts in connection with the paleontological evidence in assuming that the changes of climate during the glacial epoch have been largely, we might fairly say chiefly, the physical factors involved; but when we find, to follow Hooker's enumeration, fifty and seventy-five New Zealand plants indigenous to Northern Europe, thirty-eight common to Australia, Northern Europe, and Asia, about fifty of those of Terra-del-Fuego in North America and Europe, and close relatives of other European species on the island of Fernando Po and the mountains of Abyssinia, it is by no means easy to account for it all.

Much is still required, from different sources, in order to the future advantageous study of the whole question. It is hardly necessary to say that notwithstanding the very extensive collections of plants that already exist in numerous herbaria, the first condition of the comprehensive study of any one order with reference to its distribution is the gathering of still more of its

species, particularly from regions still imperfectly known botanically, into the great herbaria where proper facilities for study and clasification are provided.

There is great need of more exact observations of actual cases of transportation of seeds to great distances. We are not yet in a position to say, with definiteness, how much can be explained in this way. Whoever records a single absolutely reliable observation of this kind will render a good service.

Climatic changes remain, and probably must still remain, the the least definite of all the factors thus far considered. From whatever source it may come, a clearer conception of the physical conditions formerly prevailing in the Southern hemisphere seems indispensable. This is, perhaps, not hopeless, but it is, to all appearances, not likely to be immediately realized.

Paleontological evidence has been slowly accumulated, enough to show how much need there is of more. Species now perfectly isolated, living in tropical America on the one hand, and in Southern Asia on the other, have had their relations cleared up by finding their ancestral forms scattered through the intervening regions; and the prosecution of this part of the study is as hopeful as it is difficult. But the successors of Heer and Lesquereux are not likely to be numerous, nor to turn out results very rapidly.

One more side of approach remains, seemingly most hopeful, perhaps really most hopeless of all; offering almost unlimited possibilities, but involving endless labor and endless complications. This is the study of single groups from a more strictly biological standpoint. Nothing but the merest beginning has yet been made. The method is illustrated in a short paper recently prepared by Prof. Huxley; more, apparently, as a piece of tentative preliminary work suggestive of what may be done than as a formal contribution.[16]

Spending a few weeks, in the summer of '86, in the mountain region near the valley of the Rhone, he began to study some of Alpine flowers, and among them the gentians. He at once experienced trouble in "analyzing" the species, which, as in so many other cases, obstinately refused to conform to the book

[16] *Jour. Linn. Soc.*, Vol. XXIV., 1888.

descriptions, and finally set out to see for himself what such an amount of variation meant.

Confining himself to the structure of the flowers, as he afterward studied the order at the Kew Gardens, he found some seven or eight modifications of its structure, arranged in two series, and presenting a complete gradation of forms, from the completely open, stellate condition, through the bell-shaped to the extreme tubular forms with which we are best acquainted in our American flora. A comparison of these various forms indicates their derivation by successive slight modifications from an original, simple flower that Professor Huxley calls the "ur-gentian," and Müller, in the "Alpenblumen," [17] does not hesitate to employ to its full extent the Darwinian theory to explain the evolution of the more highly developed and differently colored forms to the agency of insects, particularly bees and butterflies.

If this is admitted, it becomes quite as necessary to know the whereabouts and habits of bees and butterflies as to study the gentians themselves, and the interesting hint is thrown out that those gentians that have remarkably long, tubular corollas are found in such regions as Madagascar and Guiana, with their large Lepidoptera provided with a long suctorial apparatus.

Evidently a somewhat complicated set of relations has been introduced; and after still other suggestions looking in the same direction, Prof. Huxley adds to our feeling that the subject is growing in magnitude by saying: "I think there is no greater mistake than to suppose that distribution, or indeed any other large biological question, can be studied to good purpose by those who lack either the opportunity or inclination to go through what they are pleased to term the drudgery of exhaustive anatomical, embryological, and physiological preparation."

Finally he raises the significant question: "Is anybody in a position to deny that, in the absence of all other phænogamous vegetation, the gentians might have occupied every region and station on the earth's surface in which flowering plants can exist? Is there any ground for seeking the causes of this distribution elsewhere than in the competition with other plants which they

[17] Quoted by Huxley, l.c.

have undergone and are undergoing, and in the course of which it has often happened that the success of a given form in adapting itself to certain conditions has involved a corresponding diminution of the faculty of adapting itself to others? . . . From the point of view of the evolution doctrine," he adds, "it is obvious that taxonomy and distribution have to be subjected to a process of revision which will hardly fail to revolutionize both."

Manifestly the end has not yet been reached. A panorama of more than ordinary interest has been going on, larger than it is easy to imagine, and we are barely able to get a partial view of its latest phases, or, at rare intervals, to read fragments of its history. And yet it is perfectly certain that the effort to see and comprehend more of it will never be abandoned. New glimpses are obtained from time to time as the curtain is lifted a little way, and once in a while a portion of the old record comes to light and gives new hope and a new impulse.

University of Michigan.

EDITORIAL.

EDITORS, E. D. COPE AND J. S. KINGSLEY.

THE late meeting of the American Association for the Advancement of Science, held at Indianapolis, was a pleasant and instructive occasion. The local accommodations were of the most ample character. The sections met under the roof of the State Capitol, and the conveniences of the building were thrown open to the Association. The scientists of Indiana lent their aid to render the occasion worthy of the high place which the State holds in the Union as a centre of scientific work. The city of Indianapolis contains a large intelligent and progressive element, which has kept pace with the remarkable increase in population which the city has experienced during the last decade. This intelligence was especially reflected in the press reports of the proceedings, which were among the best that the Association has received.

Many papers of a high order of merit were read, both before the regular sessions and before the botanical, entomological, and

ornithological clubs, which met at intervals during the meeting. The one excursion which the local committee arranged to come off during the session, that to the regions of the gas wells, northeast of the capital city, was well attended. To the many members who had not seen the extraordinary phenomena which these localities display, the excursion was of great interest. Perhaps the most effective scene was that witnessed at Anderson after nightfall, when the gas-jet was turned into the water of the White River. The extraordinary pressure threw the latter into a boiling caldron of flame and fluid.

—Among the various official acts of the Association there is only one to which we take exception: that is the abolition of the Committee on the International Congress of Geologists. This committee has been a useful one. It has furnished to the Congress the only complete synopsis of the geological formations of North America in existence. This work is already somewhat behind the times, so rapid is the progress of discovery, but the committee was expecting to supply such deficiency from time to time to the succeeding meetings of the Congress. But it has done more than this. It has suppressed at their inception various crude and unscientific products of the official geology of the country. It refused to adopt Director Powell's scheme for revising the colors of our geological maps, as compared with those hitherto in use throughout the world. It declined to insert in its reports the great discovery of the "Agnotozoic" (!) era, which was to occupy a position between the "Azoic" and the Paleozoic. It declined to adopt some innnovations in nomenclature desired by the same authority, regardless of the law of priority. For these and similar reasons the committee incurred the displeasure of the geological autocrat at Washington, and he determined on the control or abolition of the committee. Failing in the former, he determined on the latter, and he has succeeded. This was partly due to the weakness of some of the members of the committee themselves, who wearied, prematurely as it appears to us, of the perpetual antagonism to which they were subjected. And now we suppose that the Geology of America will be "officially" reconstructed and presented brand new to the Congress of 1892, in Washington, if any is ever held.

RECENT BOOKS AND PAMPHLETS.

ABBOT, F. E.—Scientific Theology the Ground of all Liberal Religion. Ext. *Unitarian Review*, Dec., 1889.

Annales de la Société Belge de Microscopie, Tome XIII.

Annuaire de l'Académie Royale des Sciences, des Lettres, et des Beaux-Arts de Belgiaue, 1890.

AYRES, H.—The Morphology of the Carotids. Ext. Bull. Harvard Mus. Comp. Zool., Vol. XVII.

BEECHER, C. E., and J. M. CLARKE.—The Development of Some Silurian Brachipoda. Memoirs of the New York State Museum, Vol. I., 1889. From the author.

BRIDGE, T. W.—The Air-Bladder and Weberian Ossicles in the Siluridæ. Ext. Proc. Roy. Soc., Vol. XLVI. From the author.

BRITTON, N. L.—The Genus Eleocharis in North America. Ext. *Journ. New York Microscopical Soc.*, Oct., 1889. From the author.

Bulletin No. 8, Exp. Station, Kansas State Agricultural College.

Bulletin de la Société Zoologique de France, 1889.

Bulletin of the Agricultural Exp. Station, Cornell University.

Bulletin Nos. 48–53, inclusive, U. S. Geol. Sur. From the Dept. Interior.

CALDERON, S.—La Région Épigénique de l'Andalousie et l'Origine de ses Ophites. Ext. Bull. Soc. Geol. de France, Troisième série, Tome Dix-septième. From the author.

CARTAILHAC, E.—La France Préhistorique. From the author.

CLARKE, J. M.—The Hercynian Question. Ext. Forty-second Annual Rep. N. Y. State Mus. From the author.

CONN, H. W.—Coleopterous Larvæ and their Relations to Adults. Ext. Proc. Boston Soc. Nat. Hist., Vol. XXIV., 1889.

Constitution of the Geological Society of America.

COPE, E. D.—Report on the Batrachians and Reptiles Collected by the U. S. Fish Commission *Albatross*, in 1887–'88. Ext. Proc. U. S. Nat. Mus., Vol. XII.

DERCUM, F. X.—Facts and Deductions Bearing on the Action of the Nervous System. Ext. *Journal Nervous and Mental Diseases*, Vol. XIII., 1886. From the author.

DWIGHT, W. B.—Recent Explorations in the Wappinger Valley Limestones and other Formations of Dutchess Co., N. Y. Ext. *Am. Journ. Sci.*, Vol. XXXVIII., 1889.

ELDRIDGE, G. H.—Some Suggestions Upon the Method of Grouping the Formations of the Middle Cretaceous, and the Employment of an Additional Term in its Nomenclature. Ext. *Am. Journ. Sci.*, Vol. XXXVIII., 1889. From the author.

ELLIS, H.—Women and Marriage. From the author.

Extrait du Compte-Rendu des Séances du Congrès International de Zoologie, Paris, 1889.

FRITSCH, A.—Fauna der Gaskohle und der Kalksteine der Permformation Böhmens. Selachii, Band II., Heft 4. From the author.

GATSCHET, A. S.—Linguistic and Ethnographic Notes. Ext. *Am. Antiq.*, 1889.

Geol. Sur. Kentucky, 1888.

Geol. Sur. Penna., Vol. I., 1889.

HERNANDEZ, F.—Nova Plantarum, Animalium, et Mineralium Mexicanorum Historia. From the author.

HYATT, A.—Genesis of the Arietidæ. Smithsonian Contributions to Knowledge.

IRVING, A.—Metamorphism of Rocks. From Longmans, Green & Co., publishers.

KARPINSKY, A.—Über die Ammoneen der Artinsk-Stufe und einige mit denselben verwandte carbonische Formen. Memoires de l'Acad. Imp. des Sciences de St. Petersbourg, Tome XXXVII., No. 2. From the author.

LAHUSEN, J.—Ueber die Russischen Angellen. Memoires du Comité Geologique, Vol. VIII., No. 1.

LAMBORN, R.—The Knees of the Bald Cypress. Ext. *Garden and Forest*, Jan., 1888. From the author.

LAMPERT, K.—Die Während der Expedition S. M. S. Gazelle, 1874-1876, von Prof. Dr. Th. Studer gesammelten Holothurien. Separatabdruck aus den *Zoologischen Jahrbüchern*. From the author.

LANGLEY, S. P.—The Solar and Lunar Spectrum. Second Memoir Nat. Acad. Sci.—The Temperature of the Moon. Ninth Memoir Nat. Acad. Sci.

LESLEY, J. P.—A Dictionary of the Fossils of Penna. and Neighboring States Named in the Reports and Catalogues of the Survey. Report P 4, 1889, Geol. Sur. Penna.

LOOMIS, E.—Contributions to Meteorology. Seventh Memoir Nat. Acad. Sci.

MERRIAM, H. C.—Revision of the North American Pocket Mice.—Descriptions of Fourteen New Species and One New Genus of North American Mammals.

MINOT, C. S.—Uterus and Embryo: I. Rabbit; II. Man. Ext. *Journ. Morph.*, Vol. II., 1889.

MONTGOMERY, E.—Mental Activity. Ext. *Mind*, Vol. XIV. From the author.

MOOREHEAD, W. K.—Fort Ancient, Ohio. From Robt. Clarke & Co.

NEWTON, E. T.—Description of a New Species of Clupea from the Isle of Wight. Ext. *Quart. Jour. Geol. Soc.*, Feb., 1889. From the author.

PACKARD, A. S.—On a Fossil Macruran Crustacean from Peru. Ext. Proc. Boston Soc. Nat. Hist., Vol. XXIV., 1889. From the author.

PARKER, W. K.—On the "Manus" of Phœnicopterus. Ext. *Ibis*, April, 1889.

PATTEN, W.—Studies on the Eyes of the Arthropods. Ext. *Journ. Morph.*, Vol. II., 1888. From the author.

PEPPER, W.—The University in Modern Life. From the author.

PORTER, A.—Famine Diseases. From H. K. Lewis, publisher.

Report of the Geol. and Nat. Hist. Survey of Minnesota, 1888. From the Survey.

Revue Biologique du Nord de la France, Nov., 1889.

Report U. S. Fish Commission, 1886.

Report Penna. Geol. Sur., 1887.

RIVERS, J. J.—Description of a New Turtle from the Sacramento River. Ext. Proc. Cal. Acad. Sci., Vol. II.

ROBERTS, O. M.—History and Burden of Taxation. Bull. Texas University, 1889. From R. T. Hill.

ROHANT, C. A.—Du Transformisme et de la Génération Spontanée. From the author.

SCUDDER, S. H.—The Work of a Decade upon Fossil Insects. Ext. from *Psyche*, 1890.

SHUFELDT, R. W.—Contributions to the Comparative Osteology of the Families of North American Passeres.—Notes on the Anatomy of *Speotyto cunicularia hypogæa*. Exts. *Jour. Morph.*, Vol. III., 1880. From the author.

STEARNS, R. E. C.—Ethno-Conchology: A Study of Primitive Money. Ext. Report Nat. Mus., 1886-'87.

——Description of a New Species of Alcyonoid Polyp. Ext. San Francisco *Mining and Scientific Press*, 1873.

STONE, G. H.—On the Scratched and Facetted Stones of the Salt Range, India. Ext. *Geol. Mag.*, Vol. VI., 1889. From the author.

——The Principles of Mechanics as Applied to the Solar System.

THEOBALD, W.—Index of the Genera and Species of Mollusca in the Hand List of the Indian Museum, Calcutta. Parts I. and II., Gastropoda. From the Museum.

THOMPSON, D. G.—Life, Writings, and Philosophy of Herbert Spencer. *Modern Science Essayist*, Vol. I., 1889.

TOPINARD, P.—La Société, L'Ecole, Le Laboratoire et La Musée Broca. From the author.

Transactions of the Wagner Free Institute of Science, Phila., Vol. II.

Transactions Kansas Acad. Sci., Vol. X.

TRAQUAIR, R. H.—On the Structure and Classification of the Asterolepididæ. Ext. *Ann. and Mag. Nat. Hist.*, Dec. 1888.

TRAUBEL, H. L.—Camden's Compliments to Walt Whitman.

TRUE, F. W.—On the Occurrence of *Echinomys semispinosus* Tomes, in Nicaragua. Ext. Proc. U. S. Nat. Mus., 1888.

TSCHAN, A.—Recherches sur l'Extrémité anteriéure des Oiseaux et des Reptiles. From the author.

VAN BENEDEN, P. J.—Histoire Naturelle des Delphinides des Musées d'Europe.

VOSSION, L.—The Centennial Celebration of the U. S. From the author.

VASEY, G.—List of the Plants Collected in Alaska in 1888.

WALCOTT, C.—A Review of Dr. Ells's Second Report on the Geology of a Portion of Quebec, with Additional Notes on the "Quebec Group." Ext. *Am. Journ. Sci.*, Vol. XXXIX., 1890.

——Descriptive Notes on New Genera and Species from the Lower Cambrian or Olenellus Zone of North America.—Description of New Genera and Species of Fossils from the Middle Cambrian.—Descriptive Notes of New Genera and Species from the Lower Cambrian of North America.—Description of a New Genus and Species of Inarticulate Branchiopod from the Trenton Limestone. Exts. Proc. U. S. Nat. Mus., Vol. XII., 1888.

——The Value of the Term "Hudson River Group" in Geologic Nomenclature. Bull. Geol. Soc. Am., Vol. I. From the author.

WARD, L. F.—The Geographical Distribution of Fossil Plants. Ext. from the Eighth Annual Report of the Director, 1886–'87.

——Causes of Belief in Immortality. Ext. *Forum*, Vol. VIII., 1889.

——The Paleontologic History of the Genus Platanus. Ext. Proc. U. S. Nat. Mus., Vol. XI., 1888. From the author.

WEBER, M.—Zoologische Ergebnisse einer Reise in niederländisch Ost-Indien. From the author.

WESTLING, C.—Anatomische Untersuchungen über Echidna. Bihang Till K. Svenska Vet. Akad. Handlingar, Band XV., Afd. 4, 1889.

WHITEAVES, J. F.—Descriptions of Eight New Species of Fossils from the Cambro-Silurian Rocks of Manitoba. Trans. Roy. Soc. Canada, Vol. VII., 1889.

WILLIAMS, G. H., and A. C. GILL.—Contributions to the Mineralogy of Maryland. Ext. Johns Hopkins Univ. Cir. No. 75. From A. C. Gill.

WILL, L.—Bericht über Studien zur Entwickelungsgeschichte von *Platydactylus mauritanicus*. Sitzungsb. K. Preuss. Akad. Wissenschaften, 1889. From the author.

WILSON, E. B.—The Embryology of the Earthworm. Reprint *Journ. Morph.*, Vol. III., No. 3. From the author.

General Notes.

GEOGRAPHY AND TRAVELS.

Africa.—Captain Binger's Journey.—Further particulars of Captain Binger's journey in the districts between the Upper Niger and the Guinea Coast serve to show that this is one of the most important of recent journeys, both geographically and politically. It has proved the non-existence of the Kong mountains as a defined range; has shown that there are few affluents of the Niger from the south, and that the watershed between the coast rivers and the Niger lies much farther inland than was at first supposed; and it has led to the reception under French protectorate of all the country lying between the upper Niger and the French coast possessions, so that the English settlements of the Gambia and Sierra Leone, and the independent republic of Liberia, are now framed entirely in French territory. Starting from Bammako, Captain Binger passed Likaso, and then proceeded southeastward to Kong, which he reached on Feb. 20th, 1888. The town had not previously been visited by a European. On his passage he crossed several streams, one of which proved to be a tributary of the Laku, while two others were the head-waters of the Akba, or Comoe,—all of them three to four degrees further to the north than had been supposed. The watershed was marked simply by rising ground. Kong or Pong is a considerable trade-centre; cotton-weaving, indigo-dying, and horse-trading are carried on here, and the population seems to be from twelve to fifteen thousand. After three weeks' stay in Kong, our traveller set out northwards, crossed the upper course of the Comoe, and reached the head-waters of the most westerly tributary of the Volta, the Black Volta, near the sources of the Comoe. He hurried through the country of the Gurunsi, in anarchy through the incursions of the Haussas, and reached Wagadugu, whose capital, Mossi, is in the midst of a flat country, and is rich in corn and cattle. Compelled to quit this town, he abandoned his intention of making an excursion to Libtako and connecting his surveys with those of Barth. He then proceeded south to Salaga, which he reached October, 1888, after a detention through illness at Wàle-wale of forty-five days. Following the right bank of the Volta, he entered Kintampo, a depot for kola-unts. On January 5th, 1889, he again reached Kong, where he met a

relief party, sent from the coast colonies by the governor, Treich Laplene. Both parties followed to the coast the river Akba, which is navigable as far as Attakru.

The greater part of the country included within the great northern bend of the Niger proves to be drained by the Comoe and the Volta, which latter is formed by three large tributaries, the White, Red, and Black Volta. Though there is no distinct range separating the basins of the Niger from those of the coast rivers, yet isolated granitic peaks rise above the general platform. In the west these culminate in Natinian Sikasso (2,560 ft.). Southward of this the platform sinks gradually, and here the Lahu and the Dahbu rise. Among isolated peaks more to the east is that of Kernono (4,757 ft.), which turns the course of the Comoe from east to south. From the Volta, which is surrounded with low hill-ranges, an extensive table-land stretches eastward, ascending from 3,250 feet to Nauri, in the southeast of Wagadugu, 5,905 feet high, and the highest point of the watershed, separated from the Gambaga range by the valley of the East or White Volta, which rises in Bussang. Sandstone and swamp-ore prevail in this region, which is poor, except in humid places. From March to June the heat was 104° in the shade, 140° in the sun. Captain Binger surveyed his route with the compass, and determined thirteen points astronomically. The natives belong to seven different groups: the Mondungo (Samory, Kong, Worodugu, Kurudugu, Gudja, etc.), colonised in all directions; the Sieneren or Sienufs, ranging from Tieba to Pegue, Follona, Djimmi, and Worodugu; the Gurungu, who prevail in Gurunsi and part of Bussang; the Moor Mossi; the Haussa, west of the White Volta; the Ashanti, as far as the Black Volta; and the Fulbe, whose chief abode is further north, but who have colonies to 11° N. Lat.

The Zambezi Delta.—In the March issue of the *Proc. Roy. Geog. Soc.*, 1890, D. J. Rankin gives an account of the Zambezi delta, and especially of the Chinde mouth thereof. The Quaqua cannot now be called strictly an outlet of the Zambezi, as the bulk of the waters which flow into it are derived from the drainage of the Shimwara and Achigunda hills and of the Borore heights. From Quillimane to the sea stretches a flat sodden swamp, bordered by mangroves. The tide rises to Mogorumbo, but from Lokololo to Quillimane goods have to be transported in lighters. The Kongoni mouth has 12 to 14 feet draught, but is not suitable, as its coasts are mere mangrove swamps, covered at high tides. The island of Inhainissengo is becoming rapidly

submerged. The Madredane channel, three miles long, is narrow, and so choked with reeds and aquatic vegetatation that a passage has to be hewn through it. The Mosella mouth is little known, but is said to have a bad bar at its junction with the main stream. The Melamba, Maria, East Luabo, and another mouth seem to be closed to navigation, as the sea always breaks over their bars. The Chinde mouth has, however, three fathoms on the bar at low water, and a channel 500 yards wide, and well defined. In an exceptionally dry season 20 to 23 feet were found on the bar at high water. There is a sandy point at the very mouth, and good anchorage inside it. Chinde village is at the junction with the main stream, ten miles up. The banks and channel of the main stream are continually changing direction under the influence of the immense body of water, full of vegetable matter, and depositing a light-colored ooze. The delta is thinly peopled, and the inhabitants are not indigenous, but have been slaves, and are of low social condition.

M. Dauvergne's Journeyings.—M. Dauvergne's explorations in the vicinity of the Hindu Kush, last year, led to several interesting geographical discoveries. He descended the valley of the Lung, and asserts that that river is a tributary of the Tashkurgan, and not of the Zerafshan. The valley is deep, difficult of access, warm, highly cultivated, and inhabited by Sunnite Mohammedans, who are Chinese subjects. The river flows west and southwest, with the Kundur mountains on the left bank, and the Kichik-tung on the right. Crossing the Kotti-Kandar pass (16,350 ft.), which has a glacier on the top, our traveller descended into the valley of the Tashkurgan, and then ascended that of Karachunkur. He afterwards camped with nomad Kirghises in various localities in an elevated rolling Pamir, resembling the Great Pamir.

Our traveller finds the sources of the Oxus or Amu-Daria near the pass of Wakijt-Kul, at a level of 15,500 feet, and states that they are fed by three enormous glaciers. To make certain, he followed the river for seventy miles.

It has been asserted that Karambar Sar, a small lake on the north side of the Hindu Kush, has two outlets, but one of the results of M. Dauvergne's explorations has been to dispel this idea. There are here two lakes in close proximity, the one the real Karambar Sar, about a mile and a half long, giving origin to the Karambar or Askaman River, while the other, situated a few hundred yards to the east, over a low rocky watershed, is about half a mile long, and gives outlet to the Ausa or Marghab. The smaller lake is named Gazkul.

Geographical News.—Africa.—J. R. Pigott has recently travelled up the Tana (Northeast Africa), ten days' journey beyond the farthest point reached by the Brothers Denhardt. Mount Kenia was in full sight during the latter part of the journey, and seems to be nearer the coast than has been supposed. The country is thinly peopled, for the inhabitants of the lower course of the river fear the Somalis, while those of the upper are in dread of the Wakamba. A map of the district traversed is given in the March number of the *Proc. Roy. Geog. Soc.*

A map of the journey of Mr. Selous in Mashona-land, in the basins of the Mazoe and the Mufu, tributaries of the Zambezi on the south, is given in a recent issue of the *Proc. Roy. Geog. Soc.*

Among recent journeys in South Africa deserves to be mentioned that of Mission Superintendent Knothe from Mphome on the Zoutpansberg to the land of the Bonjai or Bokharaka, southeast of the Barotse country. The Bonjai speak a language akin to the Sesuto, and are more skilled in handicrafts than the Bosuto. The brothers Posselt, in travelling north of the Limpopo to Simbabye, found certain ornaments, among which were three of gray gneiss or syenite, evidently in imitation of birds.

A small map in *Petermann's Mitteilungen*, 1890, Part I., shows the distribution of the Berber stems in Morocco. About one-half of the country is really Arab, stretching from the western limit of Algiers, south of the Ref Berbers, to the north coast by Ceuta and Tangier, and extending southward to Mogador, and inland to the Atlas. The Rif Berber element is composed of the Bezirker-Rif, the Bezirk-er-Gart, and the Isnaten, the last bordering on Algeria. The Rifs are of mid-stature, strong, broad-shouldered. They live by fishery, and by wrecking; and robbery and murder are common. Some enlist as Zouaves in the Spanish garrisons on the Morocco coast. The northern part of the Atlas is occupied by the Berbers, who for the most part are unmixed with Arab, and are slender, often over mid-height, and uncommonly muscular; the face is long, with a somewhat Roman physiognomy, and, though the tint becomes darker toward the south, the features preserve the Berber type, save where there is negro admixture. The Schloch Berbers, south of the parallel of Mogador, inhabit the lowlands as well as the mountains. They are never blond-haired like the other Berbers, but are civilized, and given to trade and handicrafts. Toward the east they become mingled with negro peoples, producing the Charatin or Draa.

King Menelik, formerly King of Shoa, is now Negus of Abyssinia, and the Italians, who favored his pretensions, have succeeded in making advantageous treaties with him, considerably enlarging the area placed under the protection of Italy.

A map of the caravan route from Zeila (British) to Ankobar, showing the routes followed by various travellers, and marking the boundaries between the Somali tribes and the Afar or Galla, is given in a recent issue of *Petermann's Mitt.*

The April issue of the *Proceedings of the Royal Geographical Society* contains an account of the explorations conducted by Mr. T. Last, as leader of the expedition to the Namuli Peaks, and the narrative is aided by a map of the part of East Africa lying between the Rovuma and the Zambezi.

Dr. Zintgraff, in his journey from the Cameroons to Adamaua in 1888–'89, had to force his way through the territory of the Banyanga, was compelled to stay three months in the land of the Bali, and in April reached that of the Bafut. On account of a threatened attack, he had to make his way through a comparatively uninhabited country. At Donga his surveys met those of Flegel. On June 11, 1889, he was at Ibi, on the Benue, whence he proposed to proceed to Jola, and then return to Bali-land.

Dr. Schweinfurth gives a full account of the excavations carried on by Flinders Petrie in the Fayoun, in *Petermann's Mitteilungen*, Part II., of this year.

A. Sharpe, in an account of his trip in the region between the Shire and Loangwa rivers, mentions that the Kirk mountains are merely the abrupt edge of the highlands that stretch to the west of the Shire valley. The Oughat or Achewa tribes have to a great extent been driven away or enslaved by the Angoni (Zulus), so that the remaining Achewas stand in great fear of the Zulus. The names of places in South Africa change as the chiefs change: thus Undi, four days west of Lake Nyassa, is named from an Achewa chief.

Petermann's Mitteilungen, 1890, Part I., contains an account of the journey of Dr. K. W. Schmid in the Comoro Islands, with a map of Angasija, or Great Comoro, and of Mohilla. The latter island is entirely covered with vegetation, but wherever the rock could be seen it was tufa. The whole eastern coast of Angasija is without a harbor, but on the east coast there is a good harbor at Mroni Bay, slightly to the north of the great volcano. The island extends about 40′ north and

south, and is quite narrow, increasing in width at its southern extremity, where it reaches 18 to 20 miles. It comprises several little sultanates. The volcano, 2250 metres high, is at the southern broad end about equidistant from each of the shores. Its crater is oval, the wall broken north and south by a lava stream.

Asia.—M. Bonvalot is now at Lob-Nor. He intends to cross Tibet, and follow the Yang-tse from the sources.

Beluchistan is now wholly British. The natives of the Zhob and Gamul valleys, and also the Wazuris, have made submission. The Zheb valley is an alluvial plain, at an average elevation of 4800 feet, and is well supplied with water, at least in the vicinity of the river. Much of territory lying between that of the Amir and what was previously British has thus now fallen into the hands of the latter. The British headquarters are now at Apozai.

H. S. Hallett considers that the earliest invaders who disturbed the repose of the aboriginal Negritos of Indo-China were the Bau of the Shan States, the Mon of Lower Burma, and the Cham of Cambodia, all of whom are Mongoloid with Malay affinities, and in West Bengal and Central India are represented by the Kolarian tribes. The La-Hu and Kiang-Tung La-Wa are said to be kindred to the white races, and were established upon the south bend of the Hong-He when the Chinese came from Chaldæa. They gradually amalgamated with their conquerers, and imported to the latter their folk-lore. The guardian spirits worshipped by the Shans are those of the ancient La-Wa kings and queens during the long wars that endured between the La-Wa and the Shans.

M. Venukoff (*Revue de Geog.*, April, 1889) asserts that the English have placed a garrison in a fort at Schahidulla, on the north side of the Karakorum range, and so near to the possessions of the Chinese in Kashgaria (Yarkand and Khotan) that they in alarm have also built a fort. Great Britain has also two other small forts northwest of the Indus, at the south foot of the Hindu Kush, and not far from the sources of the Oxus.

In Russian Turkestan an avalanche of rocks, a kilometre long, half a kilometre wide, and 100 metres thick, has fallen into the valley of the Zarafshan, and has blocked up the river, forming a lake twelve kilometres in length, threatening the district with submersion.

Salanga is a small archipelago on the western coast of Malaca, and, like Larut and Perak, is rich in tin mines. This has caused its peo-

pling by Chinese, who in 1889 numbered 40,000, while there were but 1500 natives and 500 Malays. The tin-bearing layer lies at the base of an unctious clay of varying thickness, which is itself below alluvial deposits of varying depth.

Petermann's (Part III., 1890) gives a map of the course pursued by A. Jakobsen from Flores to Kalao, Tana, Diampia, Pulo Salayer, and other small islands north of Flores. The same traveller proceeded westward to Adenare Islands.

B. Moritz contributes to the *Zeitschrifft der Gesellschaft fur Erdkunde* a paper upon the new Turkish province of Hedjaz, and the route from Mecca to Medina. The population of Hedjaz has been estimated at 700,000, but our author deems these figures too high. The nomad Bedouins are not more than 27,000 strong. Mecca has 110,000 inhabitants, Medina 40,000, Jeddah 20,000, and all the remaining towns are small. The area of the province is 1,193,517 square kilometres.

In 1888 the population of Hindustan, including Birma, was 269,477,728, or a mean density of 185 per square mile. In Bengal there are 443 persons on every square mile, in the Northwest Provinces 416, and in the central tributary states 215. Birma is the most sparsely peopled, and next to this the vassal states of Bengal, and the districts of the extreme northwest.

There are twenty thousand so-called "Mountain Jews" in the Caucascus. They have singular beliefs and superstitions, showing Persian influences, but for centuries they have had no communication with the rest of their race.

Thanks to the facilities now afforded by the Japanese government for the colonization of Hekkaido (Yesso), there was in 1888 more than seventy-seven times as much cultivated land as in 1876. The latest populations (1887) of the chief cities of Japan are as follows: Tokio, 1,165,048; Osaka, 432,005; Kioto, 264,559; Nagoya, 149,756; Yokohama, 115,612; Kobe, 103,969. The total area of the islands is 382,421 square kilometres, and the population 39,069,007, of whom 19,731,354 are men. There are 76,624 Christians, and 543 foreign missionaries.

Lieutenant Roborowsky sends from the oasis of Nice a continuation of his account of the doings of the Russian expedition under Colonel Pievtsoff. Accounts of Central Asian journeys are, as a rule, monotonous, but this is enlivened with a legend of a Mohammedan feminine saint, who, being pursued by heathen, prayed to God, and was answered

by the earth opening and swallowing her all up except her long plait of hair, which is still visible (to the head mallah only). By a new pass, the expedition will enter Tibet during the present summer. The botanical collection of Roborowsky contains 430 species.

Miscellaneous Geographical News.—The Peruvian government have despatched an expedition to the river Javary, on the borders of Peru and Bolivia, in order to chastise the Indians for the murder of of white traders. As the party includes among its members five scientific men, among whom is the well-known Richard Payer, some useful results may be looked for.

According to Venukoff, the increase in size of the delta of the Neva is small compared with that of the deltas of the Danube, Rhone, and Volga. The water of the river is comparatively free from sediment, because the principal tributaries deposit their load in Lake Ladoga, which is only sixty-five kilometres distant from the Gulf of Finland.

According to Dr. Hettner, two different peaks have been confused under the name of Coropuna. The peak called Coropuna at Arequipa seems to be higher than the true mountain of that title—which also bears the names of Arupato and Salmancay (Indian)—and is probably the highest of the entire volcanic range.

The republics of Central America propose to unite under the title of the United States of Central America. The president is to be elected annually, and to be furnished by each of the States in turn. The federal capital is to be Tegucigalpa, the capital of Honduras. The Congress will be composed of eighteen deputies, one for each 200,000 of the population, and the first meeting is to be on Sept. 15, 1890.

Dr. A. Phillipson contributes to *Petermann's Mitteilungen* of this year an account of the various elements which compose the existing population of the Peloponnesus. The Goths and other barbarian hordes ravaged and departed, so that the first immigrants who came to stay in considerable numbers were the Slavs. At the beginning of the thirteenth century the bulk of the population consisted either of New Greek, otherwise called Byzantine or Rhomæi, who inhabited the cities, especially those of the coast, and of New Greek mixed with Slav, scattered all over the country. The old Hellenic element persisted, however, in a nearer approach to purity, in Mani and Tzakonia, while the Slavic was almost pure in Arcadia and Taygetos. The Greek language eventually predominated over the Slav. Later on

came the irruption of the Arnauts or Albanians. The result is, that at the present time the old Hellenic blood has entirely disappeared, and all the people of the peninsula are more or less mixed. About 90,000, chiefly at or near Corinth, and on the Ægean coast, still speak Albanian, but all the rest of the inhabitants use modern Greek.

Dr. Hickson has published an interesting book, giving the results of his residence, for nearly a year, upon a small island off the extreme north coast of Celebes. During this stay he made excursions to the northern part of the main island, and also to Nangir, Nanusa, and Talant, small groups between Celebes and the Philippines. About half of the book concerns the northern part of Celebes, especially treating of the mythology and customs of the natives.

The greater part of the island erupted in 1885 in the Tonga group (Falcon Id.) has disappeared, and the existing island is a shelving bank to the northeast of it. The volcanic debris may now form a platform upon which a coral reef, and ultimately an atoll, may be built up.

GEOLOGY AND PALEONTOLOGY.

Newberry's Paleozoic Fishes of North America.[1]—In this volume we have collected descriptions of the fishes of the Paleozoic formations of North America, which have been discovered by Professor Newberry since the publication of his report of the geological survey of Ohio, with a few others. The species there described, as well as those described in the report of the geological survey of Illinois, by himself, Mr. St. John, and Prof. Worthen are only enumerated; and those described from the Permian beds of Illinois and Texas, by the present reviewer, are not mentioned. Add to this the fact that no bibliographic references appear, and we see that Professor Newberry has not intended this work to have the characteristics of a complete monograph. It is therefore that we welcome it as a collection of descriptions of numerous remarkable forms of early fish-life discovered by the author, which will greatly advance our knowledge on the subject. This branch of paleontology is an important one, representing as it does our knowledge of the earliest-known Vertebrata, and including as it must the ancestral types of all later forms.

[1] The Paleozoic Fishes of North America, by John Strong Newberry. Monograph No. XVI., U. S. Geological Survey. Pp. 228, plates LIII. Washington, 4to, 1889. Received July, 1890.

The volume is divided into three parts, viz.: I. On the Fishes of the Silurian System; II. On those of the Devonian; and II. On those of the Carboniferous System. The number of species referred to, and the number described in the divisions of these systems, is as follows:

	Enumerated.	Described.
SILURIAN SYSTEM.		
Onondaga Salt Series,	2	0
DEVONIAN SYSTEM.		
Corniferous,	20	14
Hamilton,	8	8
CARBONIFEROUS SYSTEM.		
Chemung,	9	9
Catskill,	9	9
Waverly,	48	5
Cleveland Shales,	28	26
Carboniferous Limestone,	347	14
Coal Measures,	27	2
Total,	498	87

Among the eighty-seven species described are a number of very interesting ones, several of which are referred to new genera. From the Corniferous series we have Acantholepis and Acanthaspis Newb., which the author thinks to be allied to Cephalaspis. From the Hamilton, Goniodus Newb., probably a Cestraciont shark; and Callognathus Newb., small forms allied to Dinichthys. From the Chemung, Holonema Newb., based on the *Pterichthys rugosa* of Claypole, a remarkable Placoderm of large size. From the Cleveland Shale, Titanichthys Newb., a member of the Dinichthyidæ, but different from Dinichthys in the slender edentulous jaws, with two species; Glyptaspis Newb., another Placoderm belonging to the Dinichthyidæ; Mylostoma Newb., another member of the same group, with flattened grinding surfaces on the extremities of the dentary bones; Trachosteus, an ally of the same family; and Actinophorus Newb., apparently a very primitive representative of the modern superorder of the Actinopterygia, and therefore a very interesting discovery. The Waverly produces the new genus Mazodus Newb., which is based on the flat-grinding teeth of some Cestraciont shark of large size. To the fauna of the Carboniferous Limestone is added the genus Cœlosteus Newb., based on a mandibular ramus, with shallow alveolæ for large teeth, probably

allied to Rhizodus. Important discussions of the characteristics of the best-known Paleozoic genera are entered on, especially of Macropetalichthys, Onychodus, Bothriolepis, Dinichthys, Titanichthys, Mylostoma, and Edestus.

In the discussion of the affinities of these and other genera, the zoologist who has gone beyond the views held in the days of the elder Agassiz will find a good deal to criticise. In fact, modern taxonomic views do not seem to have taken much hold on the mind of Professor Newberry up to the time of writing this book. The principal source of error is the tendency to compare the extinct with very different recent forms, to which they may have some superficial resemblance. This is a tendency much more praiseworthy than the opposite extreme that prevails among paleontologists—that is, the habit of neglecting existing forms, as though all of the latter have originated in modern times, which we well know is not the case. However, when Prof. Newberry compares Macropetalicthys with the sturgeons, he is certainly wide of the mark. This genus is a Placoderm, allied to Homosteus, and the areas on the cranium indicated by Prof. Newberry as separate elements, comparable to those of the true fishes and Batrachia, are not such, but are merely the spaces inclosed by the tubes of the lateral line system. (See Fig. 2, p. 43.) The true cranial segments are different, as I hope soon to show. As to the Dinichthyidæ, Professor Newberry follows Huxley in referring them, and of course other Placodermi, to the neighborhood of the Nematognathi of modern waters. Since the discovery of the dorsal fin in Coccosteus by von Koenen and Traquair, it is evident that the resemblance to the Siluroids is scarcely even superficial. In describing Cœlosteus, Prof. Newberry regards it as allied to Pappicthys, and the order of the Halecomorphi; but this cannot be accepted, as the character of the ossification is that of various truly Paleozoic types, and the general characters approach especially to Rhizodus.

In commenting on Macropetalichthys, the author asserts that the absence of lower jaw need not be regarded as a character of much importance, as is done by Haeckel and others. In this zoologists will probably agree with Professor Haeckel, and will make the systematic inferences from it which it warrants in the case of the Pteraspididæ, for example.

In his conclusion that the remarkable structures to which the name Edestus has been applied are median dorsal procumbent spines, ichthyologists will agree that Prof. Newberry has given the most plausible of all the attempted explanations yet offered.

The most complete description of structure of any of the genera enumerated, is that of the genus Dinichthys Newb. The elements of the skull and shield are pointed out, and its affinity to Coccosteus Ag. is demonstrated. Prof. Newberry shows that the eye had an osseous capsule, whose intimate structure considerably resembles that of some existing forms, as the sword-fishes. He describes a foramen which has the position of the pineal foramen of some reptiles; and shows that the eyes were protected by a ring of large bony sclerotic plates. A good deal of light is thrown on the structure of the fins. Thus Prof. Newberry believes that pectoral spines exist. If this be true, the family Dinichthyidæ may be regarded as distinct from the Coccosteidæ, where Traquair shows that they are absent. Dorsal fin elements are described from what are regarded as probably basilars. Their connections with the axial and vertebral elements are not known, but so far as they go they resemble the elements described by Von Koenen in Coccosteus, and indicate a wide difference from the structure of the Siluroids or any other Actinopterygian fishes.

The comb-like bodies found in Ohio coal measures with fishes and Stegocephalous Batrachia, originally described by the present critic in the Proceedings of the Amer. Philos. Soc., are redescribed by Prof. Newberry. He is not persuaded that Fritsch, who first found them in the Permian bed of Bohemia, has correctly referred them to the genitalia of the Stegocephali, but he is inclined to think them the teeth of fishes.

The fifty-three plates that accompany the text greatly elucidate the subject. We are sorry that they could not have been better executed, but the fault is not Prof. Newberry's. The method of illustration by phototype process has not yet attained perfection, and until it does, and so long as the U. S. Geological Survey insists on using it, there must be some scapegoats.—E. D. Cope.

Chinese Accounts of the Mammoth.—The gradual cooling of the Asiatic climate may be supported by the existence of the bones of the mammoth in northern Siberia. This hairy elephant lived in that country when the air was temperate, and when abundant forests supplied it with the young twigs on which it lived. Since that time northern Siberia has become an intolerably cold desert. The ground there is constantly frozen to a depth of more than two feet below the surface, and produces only moss, with a few modest-looking flowers. The mammoth very early drew the attention of the Chinese. It is first mentioned in the *Er-ya*, and next in Chuang-tse, in the third

century before Christ. The enormous quantities of valuable ivory which the remains of the mammoth in Siberia furnish made known to the ancient Chinese the existence of the animal through their trade with Tartary. On account of its being found in very many localities imbedded in the soil and in rocks, old books always speak of it as a monstrous mole living underground. It was found, they tell us, in China and in Tartary. Chuang-tse wrote as a poet, and pictures it (*yen shu*) as drinking a river of water before its thirst was satisfied. He had been told of the fossil bones or had seen them, and filled up the picture by the aid of imagination, either his own, or that of those from whom he heard the story. Seven centuries afterwards a medical writer, Tao Hung-king, says: "It is found in forests, and is as large as a water buffalo. It is in form something like a pig. Its color is a greyish-red. Its feet are like those of the elephant. Its breast and upper tail are white, and blunt though powerful. Its flesh is eaten, and is like that of the cow. It is known by the name 'King of the Shu tribe.' In calamitous years this animal often appears."

In the seventh century this account of the animal was discredited. Its great size was not believed. Its hiding and walking in the earth were thought absurd. These disparaging criticisms were made by Chên T'sang-chi, an eminent writer, who does not seem to have been shown any of the bones of the animal. Yet in the eleventh century Su Sung defended the statements of early writers on the subject. Bones of some large unknown animal had been found at T'sangchou, near Tientsin, just as the *Tsin* History states that at Siuencheng, a little way southwest of Nanking, there had been found similar remains in the third century. It was also related that the same animal existed in Tartary, where the larger specimens weighed one thousand catties, and was fond of living in water. It was like an elephant in the legs, though it had the hoofs of a donkey. Another place where it was found was at Tsiuning, near Pingyang Fu in Shansi. The people called it the "recumbent cow." It used to wander among the mountains at times, and drop its hair in the fields. Each one became a rat, and great was the damage to the crops. The Liang history says that in Japan there is a large animal like a cow of the Shu class, which is eaten by a great serpent. These are all instances of the mammoth ("hidden, *shu*") and prove the correctness of Tao's words. Tao has been blamed without reason by men who had not themselves inquired into the truth of his statements. The name by which this animal is known in Shensi is "the small donkey." Such are the testimonies of the existence of the mammoth collected by the author of the *Pent'sao*.

The Chinese accounts of a monster animal as given in the *Pent'sao* could not, if taken alone, be regarded as agreeing with the Siberian mammoth except in a rough way, yet they are very important. Early in this century the remains of that animal were found in so many parts of Siberia, and the ivory was of such great commercial value that the whole scientific world was interested. Cuvier in France was absorbed in the contemplation of the remarkable bones submitted to him, and decided that as the mammoth was met with often with the flesh undecayed, there must have been a sudden change of climate from temperate to extremely cold to account for the frozen condition in which the remains were found. Klaproth, who was then at Kiachta, visited the Chinese drug shops and found that the bones were known to the Chinese there. They gave him the name of the animal as it was recorded in the *Pent'sao*. It was he that suggested that the throne of ivory of the Mongol Emperors was formed of the tusks and teeth of the Siberian mammoth, and that Chinese traders for two thousand years would be ready to buy on any occasion the ivory which was from time to time discovered and brought away. He went home to Berlin, and made known to the learned world that the Chinese had accounts of the animal. The passages he translated are apparently those which are found in the *Pent'sao*, in the chapter on the class *Shu*, which includes the Rodentia with the squirrel, sable, ermine, and weasel. There can be no doubt that the mammoth, and possibly other fossil animals known to the Chinese, are assigned to the class *Shu*, because they were supposed to hide themselves in the soil of cultivated fields, and to have died underground in the position where their bones were afterwards found.

In a work published in 1887, "Mammoths and the Flood," by Henry Howorth, M.P., author of "A History of the Mongols," the attempt is made to prove that the change of the Siberian climate from mild to severe was sudden. Lyell's uniformitarian doctrine is opposed. Yet the evidence from China of a gradual change of climate in that country was not known to this author, and if he had had this evidence before him, showing as it does that there is a very slow refrigeration taking place, causing gradual changes in the vegetable as well as the animal world, he might have modified his theory. Perhaps the best form for the hypothesis to assume is that of a rapid local refrigeration in Siberia, joined with a slow refrigeration generally over the Asiatic continent. The Chinese facts on climate point distinctly to a slow refrigeration, but do not in any way suggest a sudden catastrophe by which the heat shown by the thermometer was reduced to a

large extent. The Chinese mammoth has been found in four principal localities: in the Yellow River alluvium near Tientsin, in the loess formation near the centre of Shansi, in Shensi, also on the banks of the Yangtze River in Anhui. It was this last discovery that drew the attention of Tau Hung-king, who belonged to Nanking, and being a noted Taoist, and a writer of the school of Pao Pu-tsz, would feel the deepest interest in the discovery so near his home.—*North China (Shanghai) Herald.*

MINERALOGY AND PETROGRAPHY.[1]

Petrographical News.—The results of the investigation of the clastic, metamorphic, and eruptive rocks of the Coast Ranges of California, promised by Mr. Becker a few years ago,[2] have recently[3] appeared in an extended form. The principal conclusions of the study have already been referred to in these notes. The proofs which Mr. Becker offers for the correctness of the statements that many serpentines of the Coast Ranges are altered sediments will probably be accepted by most petrographers as sufficient. His conclusion that typical diabases, diorites, and gabbros are likewise derived from clastic materials will not find such ready acceptance, as there seems to be no positive evidence that such rocks were originally sediments, rather than eruptives, which squeezed themselves into fragmental beds, and so caused the formation of a graded series, with sandstone at one end and a holocrystalline rock at the other end. There is no reason to suppose that holocrystalline[4] rocks may not have sometimes originated by metasomatic alteration of fragmentals; but the belief that a rock with the peculiar structure of diabase has originated in this way will require stronger proof for its acceptance than that offered in Mr. Becker's monograph. The presentation of a few illustrations of types of rocks intermediate between the sandstones and the diabases (pseudo-diabases of Becker, metadiabases of Dana) would have aided materially in enabling readers of the volume to draw their own conclusions as to the origin of the rocks in question. In the discussion of the massive rocks of the region, the term asperite is proposed as a general one to include all andesitic rocks with a rough trachytic habit. In this

[1] Edited by Dr. W. S. Bayley, Colby University, Waterville, Me.

[2] AMERICAN NATURALIST, Aug. 1886, p. 724.

[3] Monographs of the U. S. Geol. Survey, Vol. XIII., pp. 56-175.

[4] Cf. Van Hise. AMER. NATURALIST, 1886, p. 723.

portion of the volume are also described andesitic and basaltic glasses, which are much more acid than the holocrystalline rocks with which they are associated. The basalt glass has the composition of an obsidian, and passes into a rock with the appearance of basalt. Analyses I. and II. are of obsidian and basalt respectively:

	SiO_2	P_2O_5	TiO_2	Al_2O_3	Fe_2O_3	FeO	MnO	NiO	CaO	MgO
I.	75.40			7.72	1.41		.12		1.55	1.26
II.	57.37	.02	.60	15.66	2.06	4.46.	.27	.41	4.94	8.84

	Na_2O	K_2O	Cl	H_2O	Sp. Gr.
	8.00	4.52	.12	.43	2.39
	3.05	1.50		.74	2.83.

The difference in structure of the two rocks is supposed to be due to differences in composition of the original magma.——As an introduction to his description of the minerals of the syenite-pegmatite veins of Southern Norway, Brögger[5] gives a short account of the geology of the region in which these veins occur, and gives his reasons for regarding the lattter as eruptive in origin, as against the lateral secretion theory proposed to account for them. Since the article is itself an abstract of a monograph on the geology of the region, it is difficult to give a résumé of its contents. Among the rocks discussed are some new types, to which reference may be made. Laurvikite is a typical augite-syenite composed of anorthoclase (or cryptoperthite) diopside, ægerine, and lepidomelane, with small amounts of barkevikite, olivine, sphene, magnetite, apatite, zircon, nepheline, cancrinite, and sodalite. It is granitic in structure, except on its periphery, where it is developed as the well-known rhombic porphyry. This latter occurs also as dykes in the former and as flows. A variety of the laurvikite, in which oligoclase is present in addition to the anorthoclase, and in which the latter mineral has rectangular rather than the rhombic cross sections which characterize it in the laurvikite Brögger calls augite-mica-syenite, since it contains very little nepheline. Another rock very characteristic of the region is called laurdalite. This is a coarse-grained nepheline-syenite, with or without olivine. It contains more nepheline and sodalite than does laurvikite, and the former mineral is porphyritically developed. It is the rock described by the author as nepheline-syenite[6] in a former publication. The dyke rock corresponding to laurdalite is a nepheline-rhombic-porphyry, which differs from the porphyritic laurvikite in containing nepheline in its

[5] *Zeits. f. Kryst.*, etc., XVI., 1890.

[6] Silur. Elagen, 2 and 3, p. 273.

ground-mass. Three other varieties of dyke rock corresponding to laurdalite are recognized. The first is granitic, and is called ditroite; the second is trachytic in structure, and has been denominated foyaite; while the third has phenocrysts of elæolite in a granitic ground-mass. This a nepheline-porphyry. Hedrumite is trachytic, but it contains no elæolite, or, if any, but a small quantity. A tinguaite variety of these rocks is also recognized. Among the acid rocks a quartz-bearing augite-syenite is distinguished by the name akerite. This rock is composed of orthoclase, plagioclase, a large amount of brown biotite, idiomorphic diopside, nepheline, sodalite, usually olivine, and nearly always quartz. Its structure is granitic, and its peripheral facies is a quartz-porphyry. Several varieties of the rock were discovered, one of which is a hypersthene-akerite. More acid than akerite is nordmarkite, which is a quartz-syenite, consisting of microperthite, a diopside pyroxene, biotite, glaucophane or ægirine, and arfvedsonite, sphene, and a little zircon. It is granitic, with quartz in ordinary granite form. Since the rock contains less than 66% of SiO_2 it is called quartz-syenite, rather than soda-granite. The corresponding effusive rock is a quartz-rhombic-porphyry, with a poicilitic groundmass of quartz and feldspar. Soda-granite is developed in several varieties, among which hornblende, arfvedsonite, and ægirine varieties are the most important. The structure of the rock is not strictly granitic, consisting, as it does, of a ground-mass composed of short rectangular orthoclase, quartz, needles of ægirine, apatite, etc., with a few phenocrysts of microcline and ægirine. The author proposes that the rock be called grorudite. Very many more special phases of these various rocks are recognized, but a full description of them is left to the promised monograph. The larger part of the introductory portion of the volume is occupied with arguments to show that the pegmatitic veins so common in South Norway, as well as in other regions of old rocks, are true fillings of fissures by what was once a molten magnea.——Toula[7] announces the results of the examination of rocks collected during several trips through the Balkans. The rocks of the Central Balkans are divided into massive rocks and crystalline-schists, among the former of which granite, diorites (including nadel-diorite), uralite-diabase, microgranite, orthophyres, porphyrites, nepheline-basalt, limburgite, and andesitic and porphyritic tufas are described; among the latter granitic, hälleflinta and other gneisses and quartz-phyllites are mentioned. In the Eastern Balkans are fossiliferous sandstones and limestones and eruptive rocks, including granites,

[7] *Neues Jahrb. f. Min.*, etc., 1890, II., pp. 263, 273.

diorites, porphyrites, quartz-porphyry, andesites, and trachytes of various kinds, phonolites, augitites and tufas.——Lacroix [8] announces the discovery of a peculiar rock, composed of garnets, quartz, orthoclase, oligoclase, nitite, and diaspore, occurring in blocks cast from a volcano near Bournac in the Auvergne.——Mr. Nason [9] gives a brief description of the crystalline rocks occurring in the Highlands of New Jersey.

New Minerals.—In addition to the numerous new minerals lately discovered by Börgger in the Scandinavian Peninsula, five others have recently been described. These latter are from Sweden; the discovery of them is due to Igelström.[9]—— *Talcknebelite*, from the iron mine Hilläng, Ludvika Parish, Gouvernement Dalekarlien, is associated with small red garnets. In appearance it resembles *igelströmite*, but is lighter and has a pearly lustre on a fresh fracture. In composition it is a magnesium bearing knebelite as follows: $SiO_2 = 33.1$; $FeO = 42.6$; $MnO = 21.6$; $MgO = 4.7$.——*Ferrostibian* has been found imbedded in massive rhodonite at the Sjögrufvan Mine, Grythyttan, Oerebo. The crystals are quite large. They are probably monoclinic, and bounded by oP, $\infty P\bar{\infty}$ and $\infty P\dot{\infty}$. They are black and opaque, with a brownish-black streak, and are weakly magnetic. They have a hardness of 4, and in thin section are blood red in color. The mineral dissolves with great difficulty in the usual reagents. An analysis gave:

SiO_2	$(MgCa)Co_3$	Sb_2O_5	FeO	Mno	H_2O
2.24	2.14	14.18	22.60	46.97	9.19

Regarding the silica and carbonate as impurities, and the manganese and iron as in the "ous" condition (which could not be proven), the analysis may be expressed by the formula 10 RO. $Sb_2O_5 + 10$ (RO. H_2O).——*Pleurasite* is a hydrate arsenate from the same mine. It is implanted in arseniopleite. It is bluish-black and opaque, but in thin section becomes pale red. It has a half metallic lustre, a black streak tinged with red, and a hardness of 4, and is very weakly magnetic. It dissolves readily in dilute hydrochloric acid, and yields a yellow solution. Analyses have not yet been made, but qualitative tests indicate that it is a hydrated manganese iron arsenate, containing some antimony.——*Stibiatite*, also from the same mine, occurs in small crystals imbedded in polyarsenite and in irregular grains in veins of various minerals cutting the manganese ores of the mine. The crystals appear

[8] Bull. Soc. Fran. d. Min., Jan. 1890, p. 7.

[9] Ann. Rep. State Geologist of New Jersey for 1889, p. 30.

[9] *Neues Jahrb. f. Min.*, etc., 1890, I., p. 248.

to be orthorhombic. They are raven black and perfectly opaque even in the thinnest sections. They are easily soluble in hydrochloric acid and are not magnetic. An approximate analysis gave: $FeO = 26$; $Mn_2O_3 = 44$; $Sb_2O_5 + H_2O = 30$.——*Neotesite*, also from the Sjögrufvan, occurs in lamellar masses associated with tephroite, pyrrhoarsenite, and calcite. It resembles in appearance red orthoclase. It has a good cleavage, a hardness of 5–5.5. It is soluble in acids, leaving a residue of flocculent silica. Its composition:

SiO_2	MnO	FeO	MgO	H_2O
29.50	40.60	tr.	20.05	9.85

corresponds to $(MnMg)_2SiO_4 + H_2O$, *i.e.*, to a hydrated tephroite. The author, however, does not regard it as a decomposed tephroite.——*Antlerite* is a light green, massive mineral from the Antler Mine, Mohave County, Arizona, which, according to Hillebrand,[10] has a specific gravity of 3.93, and a composition as follows: $CuO = 67.91$; $ZnO = 16.5$; $CaO = .05$; $SO_3 = 20.77$; $H_2O = 10.93$, corresponding to $3\,CuSO_4 + 7\,Cu(OH)_2$.——*Selen-tellurium*, from El Plomo Mine, Tegucigalpa, Honduras, is nearer in composition to native selenium, according to Messrs. Dana and Wells,[11] than any substance known. It is regarded as an isomorphous mixture of the two metals indicated by its name, in the proportions $Se = 29.31$, $Te = 70.69$. It occurs massive, has an indistinct columnar structure, and is blackish-gray in color. Its cleavage indicates hexagonal crystallization.——*Durdenite*, a greenish-yellow mineral associated with native tellurium, is thought by the same authors to be a ferric tellurite corresponding to $Fe_2(FeO_3)_3 + 4\,H_2O$, but differing from the ferric tellurite described by Hillebrandt under the name emmonsite.——*Hamlinite*.—Messrs. Hidden and Penfield[12] describe a rhombohedral mineral occurring at Stoneham, Maine, in small crystals, associated with herderite, margarodite, and bertrandite. The material available for study was so small that no chemical analysis of it was possible. The crystals are bounded by oR, R, and −2R, with oR predominating, $a : c = 1 : 1.135$. The cleavage is perfect, parallel to the base, and the lustre on this face is pearly, while on the rhombohedral faces it is vitreous and greasy. The double refraction is weak and positive. Hardness = 4.5; Sp. Gr. = 3.228. Blowpipe tests prove the mineral to be a phosphate of beryllium and aluminum containing fluorine.——*Phosphosiderite* is a new mineral from

[10] Bull. U. S. Geol. Survey, No. 55, p. 48.

[11] *Amer. Jour. Sci.*, July, 1890, p. 78.

[12] *Amer. Jour. Sci.*, June, 1890, p. 511.

the Kalterborn Mine, near Eiserfeld, Siegen.[13] It is in the form of blood red or reddish-violet aggregates lining cavities in an iron ore. It is transparent, and has a hardness of 3.75, and a density of 2.76. In the glass tube it becomes yellow and opaque and loses water. Dissolves in hydrochloric acid, but is almost insoluble in nitric acid. An analysis gave $Fe_2O_3 = 44.30$; $P_2O_5 = 38.85$; $H_2O = 17.26$, corresponding nearly to $2Fe_2O_3\ P_2O_5 + 8H_2O$, which is the formula for strengite. The new mineral differs from strengite in containing about two per cent. less water, and in losing all of this in one stage. Phosphosiderite is orthorhombic, with $a : b : c = .5330 : 1 : .8772$. The cleavage is parallel to $\infty P \breve{\infty}$, which is the predominant form. Prismatic forms are also largely developed. Twins, with $P\infty$ the twinning plane, are met with. The mineral is optically positive, with $\infty P \breve{\infty}$ the axial plane and c the acute bisectrix, $2\ V_{na} = 62°4'$ and $\rho > \upsilon$. Pleochroism is $a =$ pale rose, $b =$ carmine, $c =$ colorless.

Miscellaneous.—The U. S. National Museum has just published two pamphlets of some interest. One is by Mr. Kunz,[14] and contains a readable account of the gems in the possession of the institution. The second is of more special interest to mineralogists. It is a complete catalogue of mineral names, with their synonyms in French, German, and other languages. The volume is by Dr. Egleston,[15] of Columbia. It is intended to serve as an aid to those who arrange and keep in order large collections of minerals, a purpose that it will surely serve. —— The first part of volume second of the Report of the Geological Survey of New Jersey[16] contains a full list of the minerals found in that State.——The well-known instrument maker, Fuess,[17] has recently given very full and clear descriptions of some petrographical microscopes manufactured by himself after suggestions offered by practical mineralogists and petrographers, and of some newly-constructed apparatus for use with these. The most novel of the latter are an axial angle apparatus and a goniometer attachable to the stage of the microscopes.

[13] Bruhus and Busz: *Zeits. f. Kryst.*, XVII., 1890, p. 555.

[14] Rep. Smith. Inst., 1885–6, Pt. II., p. 267–275.

[15] Bull. U. S. Nat. Mus., No. 33, Wash., 1889.

[16] Geol. Sur. of N. J. Rep. of State Geol., Vol. II., Pt. I., Trenton, 1889.

[17] *Neues Jahrb. f. Min.*, etc., BB. VI., 1890, p. 55.

MICROSCOPY.

Methods for the Preservation of Marine Organisms Employed at the Naples Zoological Station.—Unfortunately for our students, especially those living inland and depending largely for their knowledge of marine forms upon dried or preserved specimens in museums, the old-fashioned methods of throwing any material which the collector may find into a jar of alcohol without further attention, or else drying it in the sun, are still almost the only ones made use of for the preservation of museum specimens. The result is that the majority of forms which the student has for study are either dried skeletons, or shrivelled up monstrosities giving no idea whatever of the actual appearance of the creatures supposed to be represented by them. How many college museums possess a specimen of coral showing in any recognizable form the polyps by which the skeleton coral was formed? Or how many have even a satisfactorily prepared Lamellibranch?

There are, however, in this country, a few collections which show a marvellous improvement in their manner of preparation, and which have been purchased for the Naples Zoological Station, whose conservator, Salvatore Lo Bianco, has, for several years, been devoting himself to the discovery of the best methods for the preservation of the form and color of the marine animals occurring in the Mediterranean. Until the present, however, his discoveries have not been made common property, except in the few cases where the most successful methods of preserving certain forms have been published in connection with accounts of their structure. The last number of the *Naples Mittheilungen*,[1] however, contains a full description, by Lo Bianco, of the methods found most successful for the preservation of the various forms which occur at Naples, and which are undoubtedly applicable to the similar forms found upon our own coast. An abstract of these methods is given in the following pages, in the hope that they may be found useful by the museum curators of this country, and that their application may result in the much-needed improvement of the appearance of the specimens found in the majority of our college museums.

It must be fully understood, however, that much depends upon the skill of the preparator, and that want of care and patience will frequently counteract all the advantages to be derived from a good

[1] Mitth. a. d. zool. Station zu Neapel, Bd. IX., Heft III.

method. All who have had the opportunity of examining specimens prepared by Lo Bianco can appreciate readily the great advantages which may result from the careful application of his methods, and can perceive how greatly we are indebted to him and to Professor Dohrn for their publication.

Alcohol is, of course, indispensable as preservative fluid, but certain precautions are necessary in its use. Except in a very few cases it is unnecessary to use it in its full strength, 70% being quite sufficient for preservation, and producing much less contraction and fragility in delicate organisms. Strong alcohol should be reduced with distilled water to the desired strength, ordinary spring water frequently containing a sufficient amount of carbonate of lime and other substances in solution to give a cloudy precipitate, after a time, which may effectually destroy the appearance of a specimen. Furthermore, delicate organisms should first be placed in weak alcohol (35 to 50%) for from 2 to 6 hours, the changing of the fluids being effected by a siphon, a small quantity of the weak alcohol being withdrawn and stronger added, until finally the desired strength is obtained. *With delicate and gelatinous structures the increase in the strength of the alcohol should be as gradual as possible.*

In many cases it is necessary to use a hardening or fixing reagent before the final consignment to alcohol, which is principally useful as a preservative. The most useful fixing reagents, according to Lo Bianco, are the following:

Chromic Acid.—1 per cent. in fresh water. Objects should not remain in this fluid longer than is necessary to fix them, as they are apt to become brittle. Subsequently they should be well washed with distilled water to prevent the formation of a precipitate when placed in alcohol, and also to prevent their taking on too green a tinge from the reduction of the acid.

Acetic Acid, concentrated, kills rapidly contractile animals, but must be used with caution, as it produces a softening of the tissues if they are subjected for too long a time to its action.

Osmic Acid.—1 per cent. solution, hardens gelatinous forms well, and preserves their transparency, but its prolonged action renders the object brittle and gives it a dark brown tint. Objects hardened in it should be well washed in distilled water before being placed in alcohol.

Lactic Acid.—1 part to 1000 parts sea-water fixes larvæ and gelatinous forms well.

Corrosive Sublimate.—Saturated solution in fresh or sea-water; may be used either hot or cold. It acts quickly, and preserves admirably for histological purposes. It is especially good combined with copper sulphate, acetic acid, or chromic acid. Objects hardened in it should be subsequently well washed in distilled water and in iodized alcohol (the recipe for which is given below), to remove all traces of the sublimate, which in alcohol crystallizes out in the tissues of the organisms and so injures the preparation.

Bichromate of Potassium.—5 per cent. solution in distilled water hardens gelatinous organisms slowly, without rendering them fragile. It gives, however, a precipitate in alcohol, and discolors the specimen. The discoloration, however, may be removed by adding to the alcohol a few drops of concentrated sulphuric acid.

Copper Sulphate.—5 per cent. or 10 per cent. solution in distilled water, used either alone or in combination with corrosive sublimate, kills larvæ and delicate animals without distortion. The objects should be subsequently repeatedly washed with water to remove all traces of of the salt, otherwise crystals will form when the object is placed in alcohol.

Various combinations of these reagents are especially useful, and some of those most serviceable are given here:

Alcohol and chromic acid.

70 per cent. alcohol . . . . . } equal parts.
1 per cent. chromic acid . . . . . }

Alcohol and hydrochloric acid.

50 per cent. alcohol . . . . . 100 c.c.
Hydrochloric acid, concentrated . . . . . 5 c.c.

Iodized alcohol.

35 per cent. or 70 per cent. alcohol . . . . . 100 c.c.
Tincture of iodine . . . . . 2.5 c.c.

Chrom-acetic acid, No. 1.

1 per cent. chromic acid . . . . . 100 c.c.
Concentrated acetic acid . . . . . 5 c.c.

Chrom-acetic acid, No 2.

Concentrated acetic acid . . . . . 100 c.c.
1 per cent. chromic acid . . . . . 10 c.c.

Chrom-osmic acid.

1 per cent. chromic acid . . . . . 100 c.c.
1 per cent. osmic acid . . . . . 2 c.c.

Chrom-picric acid.

1 per cent. chromic acid . . . . . } equal parts.
Kleinenberg's picrosulphuric acid . . . . . }

Copper sulphate and corrosive sublimate.

10 per cent. solution of copper sulphate . . . . . 100 c.c.
Saturated solution of corrosive sublimate . . . . . 10 c.c.

Potassium bichromate and osmic acid.

5 per cent. solution of potassium bichromate . . . . . 100 c.c.
1 per cent. osmic acid . . . . . 2 c.c.

Corrosive sublimate and acetic acid.

Saturated solution of corrosive sublimate . . . . . 100 c.c.
Concentrated acetic acid . . . . . 50 c.c.

Corrosive sublimate and chromic acid.

Saturated solution of chromic sublimate . . . . . 100 c.c.
1 per cent. chromic acid . . . . . 50 c.c.

Frequently great difficulty is experienced in killing an animal without producing a considerable amount of contraction, and in the case of elongated forms, such as Nemertean and other worms, without causing them to coil up or become twisted. To avoid this, it is expedient to narcotize the animals before killing them, and for this purpose Lo Bianco recommends immersion in weak alcohol. He uses generally a mixture of sea-water 100 c.c. and absolute alcohol 5 c.c. In other cases 70 per cent. alcohol may be carefully poured upon the water in which the specimen lies, so that it forms a layer at the surface. It will gradually mix with the subjacent water, and in the course of a few hours will narcotize the animal, so that it may be treated with fixing reagents without fear of contraction.

Chloral hydrate, 1 to 2 parts to 1000 parts sea-water, is also efficient as a narcotizing agent, and has the advantage of allowing a recovery of the animal, if there should be necessity for it, by placing it in fresh sea-water.

For some sea-anemones tobacco smoke is useful, the smoke being conducted by a V-shaped tube into a bell-jar covering the vessel of sea-water in which is the anemone.

Certain of these reagents will prove most satisfactory with some animals, others with others. Lo Bianco details the best method for treating the various forms in a second portion of his paper, and an account of some of his methods of procedure, so far as they concern forms which resemble those found upon our coast, may now be presented.

Sponges.—Direct immersion in 70 per cent. alcohol, with subsequent renewal of the fluid, is recommended for the majority of forms. To avoid contraction in the case of the Halisarcidæ they should be left for half an hour in 1 per cent. chromic acid, or in concentrated solution of corrosive sublimate for fifteen minutes. To prepare dried specimens the sponges should be washed in fresh water for a few hours, and then allowed to remain in ordinary alcohol for a day, after which they may be dried in the sun.

Anthozoa.—The first care must be to place the forms belonging to this group in fresh salt-water, to allow them to expand, a result which may not be obtained until the following day in some cases. Alcyonarians should be killed with chrom-acetic solution No. 2, withdrawing the water in which they lie until there is left just enough to cover them, and then adding a volume of the chrom-acetic solution double that of the sea-water. The animals should be removed from this mixture the moment they are killed, since the acid will quickly attack the calcareous spicules, which are important for the identification of the Alcyonaria, and placed in 35 per cent. or 50 per cent. alcohol, it being well to inject the alcohol into the mouths of the polyps to keep them freely expanded. The preparation should finally be preserved in 70 per cent. alcohol.

Regarding the Actinians no definite rule for preservation can be given. Much of the success of the preparation depends on the form employed, some species contracting much less readily and less perfectly than others. Some may be killed in a fair condition by pouring over them when expanded boiling corrosive sublimate, and then, before consigning them to alcohol, treating for a few minutes with one-half per cent. chromic acid. This method may be employed with small forms such as *Aiptasia*. Narcotization may be tried with others. For this purpose remove from the vessel in which the animals are contained two-thirds of the sea-water, and replace it with a 2 per cent. solution of choral hydrate. After a few minutes the fluid is again removed, and cold concentrated sublimate solution is poured in. Tobacco smoke, in some cases, as with *Adamsia*, will act satisfactorily, if followed with vapor of chloroform for two to three hours, after which the animals may be killed in chrom-acetic, solution No. 2, and hardened in one-half per cent. chromic acid.

Edwardsia may be narcotized by gradually adding 70 per cent. alcohol to the sea-water in which they are, and subsequently may be killed with hot corrosive sublimate.

Cerianthus should be killed with concentrated acetic acid, placing it as soon as possible in weak alcohol, in which it should be suspended so that the tentacles may float freely, if necessary disentangling them.

Corals should be allowed to expand fully, and should then be killed with boiling solution of corrosive sublimate and acetic acid used in volume equal to that of the sea-water containing the coral. The colony should then be transferred to 35 per cent. alcohol, some of this fluid being injected into the mouth of each polyp. The injection should be repeated at every change of the alcohol, and the specimens should be preserved in 70 per cent. alcohol, after washing them well in iodized alcohol.

Hydromedusæ.—For the hydroid colonies the best fixing reagent is hot corrosive sublimate. The smaller Tubularian medusæ should be killed either in the mixture of corrosive sublimate and acetic acid, or in Kleinenberg's picrosulphuric acid. Larger forms may be fixed with concentrated acetic acid, and then allowed to fall into a tube containing the alcohol and chromic acid mixture, in which they are gently agitated and allowed to remain for fifteen minutes, after which they should be transferred to 35 per cent. alcohol and gradually carried to 70 per cent.

Small Campanularian medusæ, *e.g.*, *Eucope* and *Obelia*, may be killed in the mixture of copper sulphate and corrosive sublimate. *Æquorea* should be killed with concentrated acetic acid, and immediately transferred to chrom-osmic mixture for fifteen to thirty minutes. The same method answers for *Cunina*, while *Liriope* should be treated at once with chrom-osmic for five to twenty minutes.

Scyphomedusæ are best fixed with 1 per cent. osmic acid, to the action of which they are subjected until they assume a pale brown tint. They should then be thoroughly washed with fresh water before being placed in 35 per cent. alcohol, and should be finally preserved in 70 per cent.

Siphonophores.—The forms of this group should be preserved soon after capture, and specimens in good condition should be selected. *Agalma* and similar forms should be killed in the mixture of copper sulphate and sublimate, which should be used in volume equal to or double that of the sea-water in which the animal floats. The mixture should be poured in rapidly, and *not* over the animal. When killed, the specimen should be carefully lifted upon a large horn spatula, and transferred to 35 per cent. alcohol for a few hours, and then placed in 70 per cent. It is recommended to preserve the animals in tubes just large enough to contain the specimens and placed within a second lar-

ger tube. In this way evaporation of the alcohol is prevented, and also injury of the specimen from movements of the liquid is avoided.

Physalia should be placed in a cylinder filled with sea-water, the animal being lifted by the pneumatophore. When well expanded it is killed by pouring over it the sublimate and acetic acid mixture (one-quarter the volume of the sea-water), and when dead is transferred to a cylinder containing one-half per cent. chromic acid, and then after twenty minutes to 50 per cent. alcohol, and finally to 70 per cent.

Velella may be killed with chrom-picric or sublimate and chromic acid mixture, and after a few minutes should be transferred to weak alcohol. *Porpita* may be fixed by dropping Klienenberg's picro-sulphuric acid into the vessel in which it is contained, and when the blue color commences to change to red it should be transferred to Kleinenberg's fluid, and after fifteen minutes to weak alcohol.

Diphyes may be killed expanded by hot corrosive sublimate.

Ctenophora may be killed by throwing them into the chrom-osmic mixture, where they should remain for fifteen to sixteen minutes, according to the size, and then gradually passing them through alcohol to 70 per cent. A mixture composed of

Pyroligneous acid, concentrated, ...	1 vol.
Corrosive sublimate solution, ...	2 vols.
One-half per cent. chromic acid, ...	1 vol.

is also recommended as a fixative.

Echinodermata.—Starfish may be prepared with the ambulacral feet in full distension by allowing them to die in 20 to 30 per cent. alcohol.

Echinoids should be placed in a small quantity of water, and killed with chrom-acetic mixture No. 2, being removed from it as quickly as possible, as the acid corrodes the test. To preserve the internal parts it is necessary to make two opposite openings in the test, so that the alcohol may penetrate the interior readily.

Holothurians, such as *Thyone* and *Cucumaria*, after the tentacles are fully expanded, should be seized a little below the bases of the tentacles by forceps, using a slight pressure, and the anterior portion of the body should then be immersed in concentrated acetic acid. Alcohol (90 per cent.) should then be injected into the mouth, and the specimens placed in 70 per cent. alcohol. The injection should be repeated each time the alcohol is changed.

Synapta should be fixed by immersion in a tube containing a mixture of equal parts of sea-water and ether (or chloroform), where they remain completely expanded. They should then be washed for a short

time in fresh water, and passed into alcohol, taking care to increase the strength of this very gradually.

Vermes.—Cestodes, Trematodes, Turbellaria, as well as Nemathelminthes, are most satisfactorily killed with corrosive sublimate, either cold or hot. *Sagitta*, however, succeeds best in copper sulphate and sublimate or chrom-osmic mixture.

Nemerteans should be narcotized in a solution of chloral hydrate in sea-water 1 per cent., where they should remain for 6 to 12 hours. They are then to be hardened in alcohol.

Gephyreans may be narcotized with 1 per cent. solution of chloral hydrate in sea-water, or in alcoholized sea-water, 3 to 6 hours; or else may be killed at once in one-half per cent. chromic acid, which last method may also be applied to *Hirudinei*.

Chætopods are best narcotized in sea-water containing 5 per cent. of absolute alcohol, or by adding gradually to the surface of the sea-water in which they are contained a mixture of glycerine 1 part, 70 per cent. alcohol 2 parts, and sea-water 2 parts, hardening them subsequently in alcohol. *Chætopterus* is best killed with 1 per cent. chromic acid, in which they should remain for half an hour; while the Hermellidæ, Aphroditidæ, and the Eunicinæ may be killed in cold corrosive sublimate. Some of these, such as *Diopatra*, may, however, be narcotized in alcoholized sea-water. Serpulidæ, before treatment with corrosive sublimate, should be narcotized in 1 per cent. chloral hydrate, which causes them to protrude wholly or partly from their tubes.

Crustacea.—Cladocera, Copepods and Schizopods may be killed in corrosive sublimate, dissolved in sea-water. Ostracodes may be thrown at once into 70 per cent. alcohol. Cirripedes die expanded in 35 per cent, alcohol, and if some specimens contract it is easy to draw out the cirrhi with forceps. Amphipods and Isopods may pass directly into 70 per cent. alcohol, except the Bopyrids and Entoniscids, which should be killed in the mixture of equal parts of 90 per cent. alcohol and sublimate solution.

To avoid the casting off of the appendages of the Decapods they should be allowed to die in fresh water, care being taken not to allow them to remain in it longer than is necessary, as it causes a distortion of the membranous appendages.

Pycnogonids will die in one-half per cent. chromic acid with the appendages fully extended.

Mollusca.—Lamellibranchs, Prosobranchs and, Heteropods should be narcotized in alcoholized sea-water. To avoid the closure

of the valves of Lamellibranchs on immersion in 70 per cent. alcohol, little plugs of wood should be placed between the margins of the valves. The same result may be effected in the case of Prosobranchs by tying the internal edge of the operculum to the shell.

Of the Opisthobranchs the æolidæ may be best preserved by pouring over them concentrated acetic acid in volumes equal to or double that of the sea-water containing them. Dorids should first be narcotized by gradually adding 70 per cent. alcohol to their sea-water, and then killed with concentrated acetic acid or boiling sublimate. The larger forms may be killed in 1 to 5 per cent. chromic acid.

Pteropods are preserved well in Pereny's Fluid for fifteen minutes, whence they are passed to 50 per cent. alcohol. Gymnosomatous forms should be first narcotized with 1 per cent. chloral hydrate, and then killed in acetic acid or sublimate.

Decapod Cephalopods may be fixed directly in 70 per cent. alcohol, making an opening on the ventral surface to allow the alcohol to reach the internal parts.

Bryozoa.—The genera *Pedicellina* and *Loxosoma* may be left for an hour in 1 per cent. chloral hydrate, and then killed with cold corrosive sublimate, washing them immediatety afterwards. Some species of *Bugula* give good results when the expanded animals are suddenly killed by pouring over them hot corrosive sublimate. With other forms it is sometimes possible to preserve them well expanded by adding 70 per cent. alcohol gradually to the surface of the water in which they are, or by narcotizing first in weak chloral hydrate or in alcoholized sea-water. The results are, however, uncertain, and depend largely on the skill of the preparator.

Brachiopoda may be treated in the same manner as Lamellibranchs.

Tunicates.—*Clavellina*, *Perophora*, and *Molgula* may be killed with the orifices expanded by immersing them in 1 per cent. chloral hydrate for 6 to 12 hours. They should then be killed in chrom-acetic mixture, No. 2, and quickly transferred to 1 per cent. chromic acid, injecting some of the fluid into the body. After half an hour they should be transferred in 35 per cent. alcohol, the injection being repeated, and finally to 70 per cent. Other simple forms may be treated in the same manner, or may require the 2 per cent. solution of chloral hydrate, or may be killed by pouring a little 1 per cent. chromic acid on the surface of the water in which they are, subsequently hardening in 1 per cent. chromic acid. The method recommended for *Perophora* may be employed for compound Ascidians, using, however, corrosive sublimate instead of the chrom-acetic mixture.

Salpæ vary considerably in consistency, according to the species, and different methods are consequently required. The denser forms, such as *S. zonaria*, should be placed in a mixture of 100 c.c. fresh water and 10 c.c. concentrated acetic acid, where they should remain for fifteen minutes. They should then be washed in fresh water for ten minutes, and pass gradually into alcohol. Less dense forms, such as *S. democratica mucronata*, may be fixed in chrom-acetic mixture, No. 1, and then passed directly into fresh alcohol; while the soft forms, such as *S. pinnata* and *maxima*, should be placed in chrom-osmic mixture for 15 to 60 minutes, then washed in fresh water, and transferred to weak alcohol.

Fishes.—Amphioxus will die with the buccal cirrhi distended in sea-water alcoholized to 10 per cent. They should then be transferred to 50 per cent. alcohol, and gradually to 70 per cent.

Other forms may be preserved in alcohol (70 per cent.), taking care to make a ventral incision, and also to inject the alcohol and renew it frequently at first. If it is wished to preserve some of the larger Selachians for some months in order to prepare at leisure the skeleton, the intestines should be removed, and the animals placed in a 10 per cent. solution of salt.

Elasmobranch embryos may be fixed in corrosive sublimate, leaving them in the solution for 5 to 15 minutes, afterwards washing well in iodized alcohol. Embryos of *Torpedo* with the yolk were preserved by immersing them in a mixture of equal parts of 1 per cent. chromic acid and corrosive sublimate for fifteen minutes, and then transferring to alcohol.

Transparent fish eggs may be preserved for the purpose of demonstration by subjecting them for a few minutes to the action of the alcohol and hydrochloric acid mixture, and then transferring them to pure alcohol.—Playfair M'Murrich.

ENTOMOLOGY.[1]

The Long-legged Harvest Spider.—In my Descriptive Catalogue of the Phalangiinæ of Illinois[2] I described, under the name *Liobunum nigropalpi* Wood, a harvest spider that occurred rather commonly in southern Illinois, and which, from the extreme length of its legs and other characters, had been identified as the species indicated. I have lately received, however, through the kindness of Professor George F. Atkinson, specimens of a harvest spider taken in North Carolina which proves to be Wood's species, leaving the Illinois species without a name. On account of its exceedingly long legs the specific name *longipes* is proposed for it, in connection with the description given below. We have taken both sexes a number of times this season in central Ohio; and Professor Atkinson has sent a single specimen taken at Auburn, Alabama.

Liobunum longipes n. sp. Plate.—Figs. 1 and 2.—Male.—Body 4 mm. long; 3 mm. wide. Palpi 4 mm. long. Legs: I., 49 mm.; II., 99 mm.; III., 50 mm.; IV., 67 mm.

Dorsum minutely tuberculate, reddish-brown with a subobsolete dark central marking, sometimes simply represented by obscure dark blotches. Eye eminence at least as broad as high, black above, canaliculate, with small black tubercles on the carinæ. Mandibles light yellowish-brown, tips of claws black; second joint with sparse hairs. Palpi slender, light brown, distal portion of femur, and almost all of patella, black; femur, patella, and tibia with small scattered tubercles, and short hairs; tarsus, with a row of subobsolete, small, black tubercles on its inner ventro-lateral surface. Ventrum paler than dorsum, of a nearly uniform tint. Coxæ minutely tuberculate, of same color as ventrum. Trochanters black. Legs very long, slender, black with white annulations at distal extremities of femur and tibia, especially in the second and fourth pairs. Shaft of genital organ flattened, contracted near its distal extremity, and bent upwards, terminating in an acute point.

Described from many specimens.

The body of the female is slightly larger than the male, with the central marking usually more pronounced.

The accompanying plate is engraved from drawings by Miss Freda Detmers. Fig. 1 represents the male, natural size, while Fig. 2 shows

[1] Edited by Dr. C. M. Weed, Ohio Agricultural Experiment Station, Columbus, Ohio.

[2] Bull. Ill. St. Lab. Nat. Hist., Vol. III., Art. V.

PLATE XXIX.

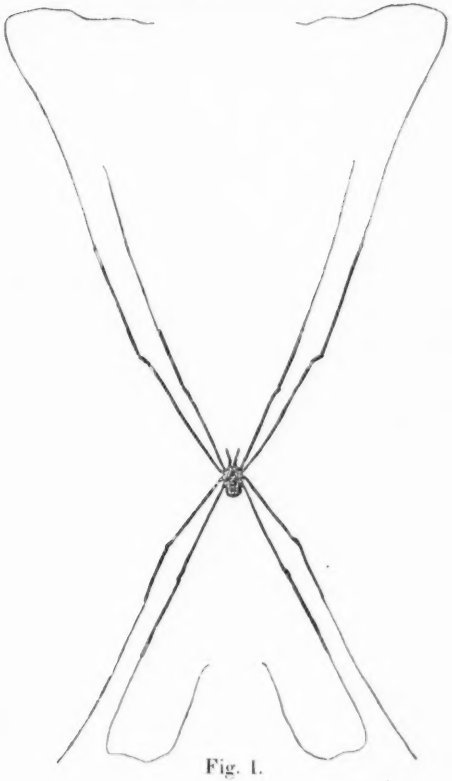
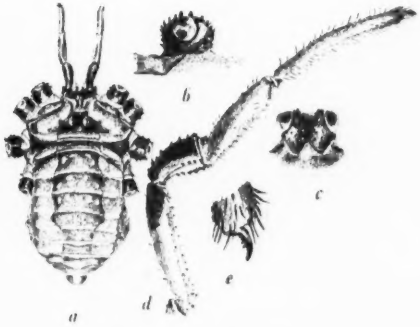


Fig. 1.



Liobunum longipes Weed.

details of the same, magnified: *a* being a back view of the body; *b*, a side view of the eye eminence; *c*, a front view of the same; *d*, the palpus, side view; and *e*, the palpal claw, side view.—CLARENCE M. WEED.

Food-Plants of the Clover-Stem Borer.[1]—Until very recently the accepted life-history of the clover-stem borer (*Languria mozardii*) rested upon the observations recorded by Professor J. H. Comstock in the Report of the U. S. Department of Agriculture for 1879. Briefly stated, these observations showed that the eggs of the insect are deposited during June in the stems of red clover; that the larvæ hatching shortly after feed upon the pith of the stalk, pupate within the burrow the same season, and emerge as beetles during August, September, and October, hibernating as adults. As to remedies, Professor Comstock says:

"It seems probable that where clover is regularly cut in early summer, and again in fall, this insect will not increase to any alarming extent; but where this is neglected, or where there is much waste clover, it may do considerable damage."

Essentially these facts and recommendations have been rehearsed by a number of writers during the last decade; but in a recent article in *Insect Life* (Vol. II., pp. 346–7), Mr. F. H. Chittenden has shown that this species develops in horse-weed (*Ambrosia trifida*), and probably also in nettle (*Urtica dioica*), daisy fleabane (*Erigeron ramosus*), and ox-eye daisy (*Chrysanthemum leucanthemum*). Mr. F. M. Webster has also found a larva indistinguishable from that of the present species in stems of timothy (*Phleum pratense*).

My observations upon this species began the present summer, and show that the insect has even a greater range of food-plants than these facts would indicate. Between July 12 and August 12, larvæ, pupæ, or adults of *L. mozardii* were found in the stems of the following plants: Yarrow (*Achillea millefolium*), sweet clover (*Melilotus alba*), wild lettuce (*Luctuca canadense* and *L. floridanum*), bellflower (*Campanula americana*), thistle (*Cnicus altissimus*), fleabane (*Erigeron philadelphicus*), and nettle (*Urtica gracilis*).

A large number of stems of red clover were examined for the insect, but none were found. Hence it seems probable that the species prefers uncultivated plants, especially the compositæ, for breeding purposes.—CLARENCE M. WEED.

[1] Read before Entomological Club, A. A. A. S., August, 1890.

Outlook for Economic Entomology.—An interesting article upon this subject, by Dr. C. V. Riley, is published in the *American Garden* for July, 1890. The author says: "All late advances in the study, and all probable advances in the immediate future, come under three chief categories: (1) The ascertaining of every detail in the life-history of species at present injurious, or likely to become injurious. (2) Thorough and careful experiments with insecticide substances. (3) The invention and improvement of apparatus for the application of insecticides. . . . As one of the immediate results of the great increase in the number of paid entomologists who are able to devote all or nearly all of their time to the work, consequent on the recent establishment of the State Experiment Stations, we may expect, after a little preliminary repetition of previously known facts and remedies in the interest of accessibility, great advance along the lines of our first category. Our knowledge of the life-histories and habits of all plant-destroying pests should take great and immediate strides, and, as I have shown, new preventives and remedies will undoubtedly result from the establishing of facts of this character. Progress in the second and third categories will be much slower. Yet we may confidently anticipate advances in the cheapening of insecticides, and in better knowledge of their properties and the conditions governing their application. We may as confidently look for cheaper and better apparatus, though radical and important discoveries in this direction are hardly to be anticipated, however much hoped for."

Recent Literature.—One of the most useful volumes ever published by the Department of Agriculture has lately been issued by the Bureau of Animal Industry. It is by Dr. Cooper Curtice, and is entitled, "The Animal Parasites of Sheep." There are 221 pages and thirty-six plates, the latter being well-executed lithographs from drawings by Haines and Marx. As Dr. Salmon well remarked in his letter of transmittal: "The subject of parasites and parasitic diseases is one of great importance, and must become more prominent as the number of domesticated animals in the country increases, and the pastures become more limited in comparison with the flocks which graze upon them. Under such conditions parasites multiply more rapidly, and their ravages become more alarming. For this reason the time has come when we must pay more attention to these organisms, and study more assiduously the means of controlling them, if we would preserve that healthfulness and vigor for which the animals of this country have heretofore been noted."

The first issue of the *Agricultural Gazette* of New South Wales, a government bulletin, contains two articles by the official entomologist, Mr. A. S. Olliff; in one the Codlin Moth is discussed, while the other treats of the Corn Worm or Boll Worm (*Heliothis armigera*), which is there called the Maize Moth. Mr. Olliff also calls attention to an injury to pumpkin vines by a plant-eating lady-bird (*Epilachna vigintioctopunctata*), an insect of the same genus as our *E. borealis*, which feeds on cucumber plants.

Bulletin No. 22 of the United States Division of Entomology consists of reports from Messrs. Coquillet, Osborn, Webster, Kœbele, Bruner, and Miss Murtfeldt, of observations and experiments in the practical work of the division. Professor Osborn's discussion of the Hemiptera injuring grasses is of special interest.

PROCEEDINGS OF SCIENTIFIC SOCIETIES.

American Association for the Advancement of Science, Indianapolis.—The officers of the meeting were: *President*, George Lincoln Goodale, of Cambridge, Mass. *Vice-Presidents: A.*—Mathematics and Astronomy—S. C. Chandler, of Cambridge, Mass.; *B.*—Physics—Cleveland Abbe, of Washington; *C.*—Chemistry—R. B. Warder, of Washington; *D.*—Mechanical Science and Engineering—James E. Denton, of Hoboken, N. J.; *E.*—Geology and Geography—John C. Branner, of Little Rock, Ark.; *F.*—Biology—C. S. Minot, of Boston, Mass.; *H.*—Anthropology—Frank Baker, of Washington; *I.*—Economic Science and Statistics—J. Richards Dodge, of Washington. *Permanent Secretary*, F. W. Putnam, of Cambridge (office Salem, Mass.). *General Secretary*, H. Carrington Bolton, of New York. *Secretary of the Council*, Harvey W. Wiley, of Washington, D. C. *Secretaries of the Sections: A.*—Mathematics and Astronomy—Wooster W. Beman, of Ann Arbor, Mich.; *B.*—Physics—(Vacancy to be filled by election in Section); *C.*—Chemistry—W. A. Noyes, of Terre Haute, Ind.; *D.*—Mechanical Science and Engineering—(Vacancy to be filled by election in Section); *E.*—Geology and Geography—Samuel Calvin, of Iowa City, Iowa; *F.*—Biology—John M. Coulter, of Crawfordsville, Ind.; *H.*—Anthropology—Joseph Jastrow, of Madison, Wis.; *I.*—Economic Science and Statistics—B. S. Fernow, Washington, D. C. *Treasurer*, William Lilly, of Mauch Chunk, Pa.

Thursday, August 21st.—Papers read in *Section E.—Geology and Geography.*—Preservation of Glaciated Rocks, by Homer T. Fuller. An Old Channel of the Niagara River, by J. T. Scovell. Niagara: A Few Last Words in Reply to Mr. G. K. Gilbert's History of the Niagara River, by George W. Holley. A Local Deposit of Glacial Gravel Found in Park County, Ind., by John T. Campbell. Concerning Some Portions of *Castoroides ohioensis* Foster, not heretofore known, by Joseph Moore. The "Barking Sands" of the Hawaiian Islands, by H. Carrington Bolton. Occurrences of Sonorous Sand on the Pacific Coast of the United States, by Carrington Bolton. Floridite, a New Variety of Phosphorite found in Florida, by E. T. Cox. The Columbia Formation in the Mississippi Embayment, by W. J. McGee.

Section F.—Biology.—Forest Trees of Indiana, by Stanley Coulter. Food of Bees, by A. J. Cook. A Case of Morbid Affection of the Eye in a Cat, by C. L. Herrick. Preliminary Notes on a New and Destructive Oat Disease, by B. T. Galloway. Observations on the Variability of Disease Germs, by Theobald Smith. Changes in the Ciliated Areas of the Alimentary Canal of the Amphibia During Development, and the Relation to the Mode of Respiration, by Simon H. Gage and Susanna P. Gage. Combined Aerial and Aquatic Respiration in Amphibia, and the Functions of the External Gills in Forms Hatched on Land, Simon Gage. The Trimorphism of *Uromyces trifolii*, J. K. Howell, presented by W. R. Dudley. The Harvest Spiders of North America, by Clarence M. Weed. Morphology of the Blood Borpuscles, by C. S. Minot. Observations on the Life-History of *Uncinula spiralis*, by B. T. Galloway. On the Seed Coats of the Genus Euphorbia, by L. H. Pammel. Observations on the Method of Growth of the Prothallia of the Filicineæ, with Reference to their Relationship, by Douglas H. Campbell. Development of the Sporocarp of *Griffithsia bornetiana*, by V. M. Spalding. Contributions to the Life-History of Isæus, by Douglas H. Campbell.

Section H.—Anthropology.—Indian Origin of Maple Sugar, by H. W. Henshaw. Fort Ancient, by W. K. Moorehead. Aboriginal Stone Implements of the Potomac Valley, by W. H. Holmes. Suggestion for a Pan-American as Precursor to an Universal Language, by R. T. Colburn. Dialectic Studies in the Swedish Province of Dalecarlia, by J. Muller. Notice of a Singular Earth-work near Fosters, Little Miami Valley, Ohio, by F. W. Putnam.

Papers read on Friday, August 22d, in *Section E.—Geology and Geography.*—What Constitutes the Taconic Mountains? N. H. Winchell. The Formations and Artesian Wells of Memphis, Tenn.,

James M. Safford. Progress in Morainic Mapping, T. C. Chamberlain. Remarks on Construction of Topographic Maps for Geologic Reports, Arthur Winslow. Notes on the Occurrence of Pegmatite in Central Missouri, Arthur Winslow. The Amount of Natural Gas Used in Glass Manufacture, Edward Orton. Differentiation of Subterranean Water Supplies, J. E. Siebel. Some of the Qualifying Conditions of Successful Artesian Well-Boring in the Northwestern States. C. W. Hall. A Notable Dike in the Minnesota River, C. W. Hall. Topographical Features of Arkansas Marbles, T. C. Hopkins. The Origin of the Manganese Ores of Northern Arkansas and its Effect on the Associated Strata, R. A. F. Penrose, Jr. The Novaculites of Arkansas, L. S. Griswold. Subsidence and Deposition as Cause and Effect, E. W. Claypole.

Section F.—Biology.—The seven following papers were assigned at the Toronto meeting, under the general head of "Geographical Distribution of North American Plants:" The Relation of the Mexican Flora to that of the United States, Sereno Watson. The Distribution of the North American Umbelliferæ, John M. Coulter. The Distribution of Hepaticæ of North America, Lucien M. Underwood. The Migration of Weeds, Byron D. Halsted. Geographical Distribution of North American Grasses, W. J. Beal. Geographical Distribution of North American Cornaceæ, John M. Coulter. The General Distribution of North American Plants, N. L. Britton. On the Plates of *Holonema rugosa*, H. E. Williams. On the Structure of Certain Palæozoic Fishes, E. D. Cope. External Termination of the Uretha in the Female of *Geomys bursarius*, Herbert Osborn. Work of the Botanical Division of the Department of Agriculture, F. V. Coville. On the Lack of the Distance Sense in the Prairie Dog, Burt G. Wilder. Disappearance of the *Decidua reflexa*, C. S. Minot. The Continuity of Protoplasm Through the Cell-Walls of Plants, W. J. Beal and T. W. Tuomey. Potato Scab, a Bacterial Disease, H. L. Bolley.

Section H.—Anthropology.—Exhibition of Diagrams of the Brains and Medisected Heads of Man and a Chimpanzee, Burt G. Wilder. Peculiar Effects of One-sided Occupations on the Anatomy and Physiology of Man, J. Muller. Exhibition of a Bone Image from Livingston County, N. Y., C. C. Abbott. Exhibition of Gold Beads of Indian Manufacture from Florida and New Jersey, C. C. Abbott. Notice of a Singular Earth-work near Fosters, Little Miami Valley, Ohio, F. W. Putnam. A Study in Mental Statistics, J. Jastrow. Arts of Modern Savages for Interpreting Archæology, O. T. Mason.

Papers read on Monday, August 24th, in *Section E.—Geology and Geography.*—Subsidence and Deposition as Cause and Effect, E. W. Claypole. On the Paleontological and Geological Relation of Closely Similar Fossil Forms, C. A. White. The Crystalline Rocks of Central Texas, Theo. B. Comstock. The Geology of the Wichita Mountains, Indian Territory, Theo. B. Comstock. The Silurian System and Its Geanticline in Central Texas and Indian Territory, Theo. B. Comstock. Topographical Evidence of a Great and Sudden Diminution of the Water Supply in the Ancient Wabash, John T. Campbell. Glacial Action Considered as a Continuous Phenomenon, Having Shifted from One Locality to Another, P. H. Van der Weyde. Geology of Indian Territory South of Canadian River, R. T. Hill and James S. Stone. The Recent Explosion of Natural Gas in Shelby County, Ind., H. E. Pickett and E. W. Claypole. Note on the Stony Meteorite that Recently Fell in Washington County, Kan., E. H. S. Bailey. The Bendigo (Brazil) Meteorite, Orville A. Derby. A New Method of Searching for Rare Elements in Rocks, Orville A. Derby. Observations on the Genesis of Certain Magnetites, Orville A. Derby. Nepheline-Bearing Rocks in Brazil, Orville A. Derby.

Section F.—Biology.—The Development and Function of the So-called Cypress "Knees," with a Consideration of the Natural Habitat of the Tree, W. P. Wilson. Potato Scab, a Bacterial Disease, H. L. Bolley. The Continuity of Protoplasm Through the Cell-Walls of Plants, W. J. Beal and T. W. Tuomey. Preliminary Note on the Genus Rhynchospora in North America, N. L. Britton. On Rusbya, a New Genus of Vacciniaceæ from Bolivia, N. L. Britton. The Distribution of Land Birds in the Philippine Islands, J. B. Steere. Exhibition of Diagrams Illustrating the Formation of the Human Sylvian Fissure, Burt G. Wilder. Structure of the Stomach of *Amia calva*, G. S. Hopkins. Differentiation of the Primitive Segments in Vertebrates, C. S. Minot. A Support for the Chorda Tympani Nerve in Felidæ, T. B. Spence. Notes on the Amphibia of Ithaca, Simon H. Gage and H. W. Norris.

Section H.—Anthropology.—The Form of the External Ear, H. D. Garrison. Preliminary Steps to an Archæological Map of Franklin County, Ind., H. M. Stoops. The Relation of Mind to its Physical Basis, E. D. Cope. Remarks Upon the Mounds of Sullivan County, Ind., J. W. Spencer. On the Atbatl or Spear-Thrower of Ancient Mexico, Zelia Nuttall. On an Ancient Hearth in the Little Miami Valley, F. W. Putnam. The Evolution of a Sect, Anita Newcomb McGee. On Obsidian Implements of California, H. N. Rust. The

Basket-Mortar of Southern California, H. N. Rust. The Adze, H. N. Rust.

Papers read on Tuesday, Aug. 25th.—*Section F.—Biology.*—Account of the Marine Biological Laboratory at Wood's Holl, C. S. Minot. The Desirability of Establishing a Biological Station on the Gulf of Mexico, W. P. Wilson. Potato Scab, a Bacterial Disease, H. L. Bolley. The Continuity of Protoplasm Through the Cell-Walls of Plants, W. J. Beal and T. W. Tuomey. Preliminary Note on the Genus Rhynchospora in North America, N. L. Britton. On Rusbya, a New Genus of Vacciniaceæ from Bolivia, N. L. Britton. Notes on a Monograph of the Genus Lechea, N. L. Britton.

The general session of the A. A. A. S. transacted a large amount of business, and the next meeting, to be held in the city of Washington, in August, 1891, will open with a clear page. It was voted that names of candidates for fellowship must be presented before the first meeting of the council in each year. A resolution was passed instructing the committee on forestry to bring the matter of preserving the groves of Sequoia trees of California to the special attention of Congress and the Secretary of the Interior.

A resolution was passed recognizing the services to science of Senors Barao de Guahy and Jose Carlos de Carvalho, citizens of Brazil, who by the expenditure of many thousands of dollars by the first, and many months of gratuitous labor on the part of the latter, caused to be transported from its original position in the interior of the State of Bahia to the National Museum in the city of the Rio de Janeiro the famous Bendigo meteorite, the largest mass of sidereal matter ever placed in any museum. This meteorite is said to weigh about five tons.

The committee on reduction of tariff on scientific books reported progress, and an item providing for the free transportation of scientific books by individuals has been introduced into the McKinley bill. As this item embraces only books in languages other than English, representations have been made by the committee to members of the Ways and Means Committee of the Senate which, it is hoped, will result in the inclusion of scientific books printed by the English government and scientific societies.

It was resolved that the A. A. A. S. request of the Secretary of the Navy the careful consideration of the memorial recently presented by various observatories relative to furnishing of time signals to the Western Union Telegraph Company by the naval observatory for commercial purposes. It was also resolved that the association joins the observatories of the United States and Canada in asking the Secretary

of the Navy to consider the system which has been established at the naval observatory, in pursuance of which time signals are given for commercial purposes to the Western Union, and to cause this practice to be so changed as not to injure the work of the local observers.

Mr. Amos W. Butler moved that the permanent secretary be empowered to extend invitations to the governments of Mexico, Central and South America to send delegates from the different scientific societies of those countries to the meeting of the association at Washington. The resolution was adopted, after which Permanent Secretary Putnam announced that of the 364 members and associates in attendance upon the present meeting, Indianapolis furnished 27; Indiana, outside of Indianapolis, 64; Ohio, 38; New York, 29; District of Columbia, 30; Illinois, 26; Michigan, 22; Massachusetts, 19; Kentucky, 14; Iowa, 12; Pennsylvania, 12; Missouri, 12; New Jersey, 6; Nebraska, 6; Wisconsin, 5; Tennessee, 4; Arkansas, 2; Maine, 2; Canada, 6. There were also representatives from Rhode Island, West Virginia, England, Scotland, New Hampshire, Arizona, Texas, and other States.

The resolutions of thanks comprehended nearly all the railroad companies that enter that city, the street-railroad company, the people of Indianapolis, Noblesville, Kokomo, Marion, Muncie, Anderson, Terra Haute, and New Albany, the local committee, the ladies of that committee, and the press. The various corporations, committees, and persons thus thanked were not disposed of in one resolution, but taken up seriatim and each brought, as in toast-making, for a little speech from the proposer, and one from the gentleman designated to respond. In this way speeches were made by Mr. F. E. Nipher, of St. Louis; Prof. E. T. Cox, of New York; Prof. E. D. Cope, of Philadelphia; Secretary Putnam, of Cambridge, Mass.; Mr. A. W. Butler, of Brookville; Mr. A. F. Potts, of Indianapolis; Professor Avery, of Cleveland; Professor Abbe, of Washington, D. C.; President-elect Prescott, of Ann Arbor; Professor Mees, of Terre Haute; Dr. Hover, of New York; Professor Mason, of Washington, D. C.; Mr. G. W. Holley, of Ithaca, N. Y.; Prof. Stanley Coulter, of Lafayette; Prof. Charles R. Barnes, of Madison, Wis.; and ex-President Mendenhall, of Washington, D. C. After this the meeting adjourned.

On Saturday, August 23d, an extensive trip was arranged to cover the immense gas territory of Indiana.

A special train was provided, which left the city in the morning, going north over the Lake Erie & Western R. R., through Noblesville to Kokomo, where the gas field was explored, and a visit made to

the largest plate glass factory in the United States, and other establishments where natural gas is applied to manufacturing uses.

From Kokomo the party was taken to Marion, from there to Muncie, and from Muncie to Anderson, where a magnificent display of gas at night was given, embracing a beautiful and fantastic feature, by the introduction of a gas-main under the White River. From Anderson the party returned to Indianapolis, arriving at midnight.

On Monday afternoon a special train took the botanists to South Waveland, where carriages were provided to take them to the "Shades of Death." A lunch was served before returning.

The Science Club, of Terre Haute, invited Sections B, C, and D to hold their session at the Rose Polytechnic Institute, Terre Haute, on Friday, August 22d, which invitation was accepted. A lunch was served by the citizens of Terre Haute.

The citizens of Lafayette extended an invitation to Section F to visit Lafayette, but the Section thought it impracticable to accept.

A special excursion was secured from Indianapolis to the Mammoth Cave of Kentucky, Wednesday, August 27th.

SCIENTIFIC NEWS.

The Delaware Valley Ornithological Club.—Recognizing the advantages to be gained by combined work, a number of ornithologists residing in the vicinity of Philadelphia have organized the Delaware Valley Ornithological Club, for the study of the birds of southeastern Pennsylvania and southern New Jersey, with especial reference to their migration in the valley of the Delaware River. The active membership of the club is limited, and consists only of those who have had considerable experience in field work, and are known to be thoroughly reliable. An associate membership has been added to include beginners in the study who can furnish data subject to the approval of the active members, and in return can receive the benefit of their experience.

The following is a brief outline of the methods of work of the club: Daily field notes are taken by the members, and recorded systematically on monthly charts containing vertical columns for the days and horizontal ones for the birds in the order of their occurrence during the month. The spaces are sufficiently large for recording the number of birds seen (as recommended by Mr. Batchelder, in the April number of *The Auk*), and short abbreviated notes as to singing,

mating, nesting, etc. Across the top of the chart are blanks for recording the curve of temperature variation, the direction and force of the wind, and other corellative notes. In addition to these individual charts there are "combined monthly charts," on which the notes of all the observers are recorded, followed by private marks indicating their various stations. These charts are passed from one member to another, and when all the data have been recorded are reproduced by a copying process and copies furnished to each observer. In the same way it is proposed to have yearly charts on which will be recorded the first and last occurrence, arrival and departure of bulk, and other general facts relating to each species.

The club meets in Philadelphia twice a month, when all matters of importance are discussed and specimens exhibited.

Another aim of the club is to keep a complete record of all the birds which occur in southeastern Pennsylvania and southern New Jersey, and of the breeding habits of those species which remain in this district during the summer. These observations will cover a wider field than those on migration, the latter being confined to the immediate vicinity of the Delaware River south of Trenton, as it is thought that better results can be obtained by restricting the country covered by the observations to one river rather than by including other river or coast districts.

During the present year the club has seven regular observers,—Wm. L. Baily at Wynnewood, Pa.; Samuel N. Rhoades at Haddonfield, N. J.; J. Harris Reed at Tinicum Island, Pa.; Geo. Morris at Olney, Pa.; Dr. Spencer Trotter at Swarthmore, Pa.; Chas. A. Voelker at Chester, Pa., and Witmer Stone at Germantown, Pa.

The results so far have been highly satisfactory, and have far surpassed our expectations. We therefore thought by stating our methods of work other observers similarly situated might be led to "join their forces" and gain the benefit of each other's work as we have done.

This work need not interfere in any way with that being conducted by the Department of Agriculture, as the correspondents of the Department can fill out their schedules as heretofore, or they can substitute the combined report of the club, as may be desired. In any case the results obtained by the combined efforts of a number of observers in a small district cannot fail to be of service to the Department when it undertakes to work out the migration through the country at large.

At the close of the year we hope to present to *The Auk* an abstract of the migration of 1890 as it occurred in the valley of the Delaware, with a map showing the district covered by each observer.—WITMER STONE *in The Auk.*